



JPRS Report

Science & Technology

Europe

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Science & Technology

Europe

JPRS-EST-88-008

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AEROSPACE, CIVIL AVIATION

USSR, PRC, Japanese Launch Programs Compete With Ariane

3698M422 Milan *INDUSTRIA OGGI* in Italian
No 15, May-Jun 88 pp 62-64

[Interview with Amalia Ercoli-Finzi, professor at Politecnico di Milano and member of the TSS [Tethered Satellite System] program in association with NASA: "Ariane: Competition Comes From the East"; by Letizia Grisoli]

[Text] Realization of the Ariane program took on enhanced importance for the Western world after the Shuttle disaster, when it became necessary to reprogram the satellite launches that had been assigned to the Shuttle. *INDUSTRIA OGGI* has met with Amalia Ercoli-Finzi, professor at Politecnico di Milano and member of the TSS program in association with NASA. With the Italian scientist, we discussed Ariane and the European aerospace outlook.

INDUSTRIA OGGI: Could you give us an opinion as to the validity of the Ariane Project, describing it to us, indicating what countries participate in it, their specific roles, and Italy's in particular?

Amalia Ercoli-Finzi: The Ariane Launcher Program is of particular importance to Europe and to the entire world: To the world because it represents a further means of launching satellites and other spaceborne objects; and to Europe because it provides Europe the means of achieving independence with respect to the orbital injection phase. Since the dawn of the space age, Europe has dreamt of a European launcher; but it was not until 1973 that the ministers of the European Community countries participating in the ESA [European Space Agency] launched the Ariane Program.

Even though this launcher has been France's baby, whose development has been nurtured by the French CNES [National Center for Space Studies], it nevertheless represents an excellent proving ground for the development of technological cooperation among different countries and an irreplaceable vehicle for the transfer of know-how.

Ariane, which has now flown in various versions, has proven an excellent performer, having put into orbit payloads weighing in the order of tons. The fact that accidents have occurred—in one of which our Sirio 2 satellite was lost—is a thing to be expected in the realm of launchers. Suffice it to recall that some American launchers have had, during the early years of their lives, a mortality rate of 90 percent. Italy participated, somewhat marginally though it was, in the first versions, building fire walls, fairing supports, and valves; whereas, beginning with Ariane 4 it has been more deeply

involved. As a matter of fact, Aeritalia has total responsibility for the auxiliary booster tanks as well as a large number of minor components that nevertheless still require the usual high level of technological know-how.

The availability of the Ariane launcher has taken on particular importance at this point in time when the Western world finds its alternatives greatly reduced in number, owing to the crisis that besets the American Space Shuttle, whose grounding has compelled the reprogramming of satellite launches that had been assigned to the Shuttle. The United States is now reassessing its positions and weighing the possibility of resuming the building of expendable launchers. The Shuttle is a stupendous machine, but an extremely complex one owing to the presence of human beings aboard it, and thus an extremely costly one in terms of the need for sensitive equipment and systems, reliability and safety requirements.

It is a truly expensive realization and one whose use is not justifiable for missions not requiring human intervention, as in the case of putting telecommunications satellites in orbit, wherein an automatic system is entirely adequate. As for the Shuttle, judging from published reports, current plans do not call for substantial modifications to the model that is to fly, one hopes, this year. What is being done amounts to a very detailed testing of all components, minor changes in the seals, and, above all, a thorough analysis of all potential causes of a malfunction.

In substance, the overall project remains unchanged, and this could mean the retention of high margins of risk.

Returning to Ariane—which, as I have said, has performed very well to date (a launch last September, for example, put two telecommunications satellites in orbit)—it currently has orders in hand for over 40 launches, half of which are for extra-European clients. Expectations are high for Ariane 5, a super-launcher capable of injecting satellites weighing 6 tons into geostationary orbit.

Personally, however, when it comes to putting Hermes—the European space plane that is to carry up to 4 astronauts—into space, I foresee problems. In substance, this vehicle will have very little to offer from the standpoint of spaceborne operations, or at least, much less than had been anticipated, in that, the design has had to be scaled down in size and the cargo bay, which had initially been intended to be openable, has now been redesigned to remain closed, precluding any direct communication with the outside.

There are uncertainties as to the aerodynamic forces connected with placing this space plane at the front end of the launcher and as to the destabilizing effects they could have on the latter's motion. The additional fact remains that Hermes is an outdated project over 10 years old, but it must be implemented anyhow, because France

has made its implementation a prior condition to participation in the European space program. The alternative to Hermes is the HOTOL [Horizontal Takeoff and Landing] space plane proposed by the British, which takes off horizontally, behaves like a space vehicle, and returns gliding, like the Shuttle.

In my view, the HOTOL could be the key to the resolving of Europe's space plane problem, even though much remains to be done technologically from the standpoint of its realization: The principle on which it is actually based—namely, the use of atmospheric oxygen for its propulsion during the launch phase—is absolutely innovative and will require years of study and research.

INDUSTRIA OGGI: Can you tell us which are Ariane's competitors, and how the Russians' and Chinese's technological lag, with respect to the West, is reconcilable with their reliability?

Amalia Ercoli-Finzi: This question regards what the Russians, Chinese and Japanese have to offer. And in this regard there are distinct differences, because the Russians, Chinese and Japanese are not all at absolutely equal levels of competitiveness. The Russians have a launcher capability that defies the imagination. Last year, for example, between 1 August and 11 September, 10 satellites were launched: 8 Russian, 1 Chinese, and 1 Japanese.

The Russians execute two launches a week, while the other countries are barely able to execute, at the very most, one a month.

They have developed space maneuvering techniques, such as automatic rendezvous and docking, that are completely standardized and therefore easily executed and extremely reliable. Operating in the space environment where microgravity facilitates the carrying out of processes that are impossible in Earth's terrestrial environment, they are now developing a full-fledged space microgravity industry for the production of extremely pure material suited, for example, to electronics applications.

Russia's advantage includes not only its launch capability, but also its satellite tracking capability—that is, its ability to track the satellite throughout the duration of its mission, insert it into its proper orbit in the event the launch was not perfect, and execute orbital and attitude maneuvers. This does not hold true, or at least not to the same extent, for the other countries.

INDUSTRIA OGGI: As for the Chinese, what is the extent of their capability? What is the source of the Chinese's know-how?

Amalia Ercoli-Finzi: The Chinese have a very competitive launcher—the Long March III—which has now passed all qualifying tests to perfection and is available

in various versions. Obviously, China's launch capability was initially rather low, but its programs for the coming years are based on the putting of 9-ton payloads into low-earth orbit and 4-ton payloads into geostationary orbit. The Chinese, however, are still not at the level of capability required for developing missions of large-scale complexity. The Japanese, on the other hand, are in a more competitive position versus Ariane.

In this regard, I would add that, rather than competition, it is international cooperation in the field of aerospace that needs to be developed, so as to coordinate technological know-hows and, by way of this mutual exchange, to enhance aerospace research and progress.

The Shuttle disaster has also led to serious consideration of using Russian, Chinese and Japanese launchers to put our satellites in orbit—launchers which, although utilizing a more "primitive" technology than the Shuttle, are nevertheless, capable of effecting successful launches.

In any case, space activity cannot be brought to a halt and it is therefore not possible to wait for the Shuttle to fly again, which will not be until the end of 1988. Space activity is too important to the future of humanity. In fact, beyond its role in telecommunications, meteorology, and earth observation—activities that have now become commonplace—it now looks forward to "diversified" activities, including the production of new medicinal, new alloys, new materials. Space is a training ground for learning to master phenomena in their true reality that are altered on Earth by gravity.

Then there is engineering, which has great prospects for development in space, insofar as concerns, for example, the construction of vast deployable antennas, space stations, and satellites for the production of electrical energy, and so forth. Italy has participated in over 200 space programs, including Ariane, which is a European program. There are exclusively Italian programs: SAX, which includes the study and realization of a scientific satellite with a payload centered around experiments in X-ray astronomy, designed to explore the universe, in the energy bands comprised within the 0.3-to-200 keV interval.

The program entered its developmental phase recently, and cooperation was defined with the Dutch NIVR, which will build the Wide Field Cameras and design and build the satellite attitude control system.

The IRIS program, on the other hand, covering an intermediate booster stage for the transfer of payloads from low-earth to geostationary orbit, is designed to become an integral part of the Space Shuttle system and enable the injecting of loads weighing between 600 and 1,000 kg into orbit, including the Italian Lageos II satellite for which Aeritalia is the prime contractor.

We expect very big things from the Columbus program, covering an orbital laboratory designed to be incorporated into the future American space station. Plans also call for subsequently converting the Columbus into a free flyer; that is, a self-powered orbital station. In this project, Italy will build the "garbage can"; that is, the pressurized compartment that will carry all the experiments to be performed. It had been planned that the Columbus would fly with the Shuttle in 1992, but the date has now been slipped to around 1996.

Another Italian project is the Tethered Satellite System, conceived by Giuseppe Colombo and developed jointly with NASA. This satellite is tethered to the mother vehicle—the Shuttle—by means of a long cord some 100 kilometers in length, and operates in zones whose atmosphere is so rarefied as to preclude their being accessed by other satellites or airplanes. The TSS is at an advanced stage of construction.

INDUSTRIA OGGI: You are one of the very few women in Europe in the Space sector. Going back to the topics discussed at the congress organized by Italtel in September on the presence of women in the aerospace and advanced technologies sectors, what are the reasons for the scarcity of women in this sector?

Amalia Ercoli-Finzi: In the space field, very few women are found at the higher levels—on the one hand, because there still exists a great distrust as to their capabilities, and on the other, because women distrust their own capabilities and have not the slightest thought of entering this field.

It is too bad indeed, because women have an innate aptitude for entering new environments requiring a large measure of curiosity and imaginativeness, which are typical feminine qualities. The activity in the aerospace sector would be particularly suited to their temperament, in that, it is a systemic activity that requires outstanding ability to grasp a situation and act with decisiveness and speed. These are qualities that are generally characteristic of women. A historical reason for this nonpresence may be that the first operators in the aerospace sector came from the Air Force, where there was a total absence of women.

Presently, with the new generations, we are witnessing a change in the situation. We are beginning to see a larger number of women in research on the dynamics of spaceborne structures and in the sphere of control.

Women are currently entering the realm of space by way of dead-end research jobs, but this situation is fast changing. Personally I am optimistic as to the outlook for the employment of women in the realm of new technologies, and particularly in the space sector.

[Boxed insert p 63]: Ariane is a family of 3-stage spaceborne launchers, the development of which was decided in 1973 by 10 European member countries of the ESA

[European Space Agency]. Commencing with a basic configuration baptized Ariane 1, capable of putting payloads weighing 1,700 kg into transfer orbit, the payload capacity of the launcher was successively increased to 2,000 kg (Ariane 2) and 2,500 kg (Ariane 3).

Ariane 5 is part of a family of launchers of extremely advanced design. The family includes a 3-stage launcher with a payload capacity of 5,500 kg and a 2-stage launcher capable of putting a self-powered, manned vehicle weighing 10,000 kg, and baptized Hermes, in orbit.

Ariane's first operational flight lifted off at Kourou (Guyana) on 16 June 1983.

9238

France: Mission, Staffing of ONERA Documented
3698a192 Chatillon-sous-Bagneux ONERA
ACTIVITIES 1986 in English Jun 87 pp 6-20

[Text]

I. General

1. Historical Survey

ONERA [National Institute for Aerospace Research and Studies] was founded in 1946 as a scientific and technical public establishment, managed according to industrial and commercial practice, enjoying financial autonomy and placed under the authority of the Minister of Defence or, more precisely, the General Delegate for Armament (DGA), equivalent to the British Procurement Executive or the U.S. Director of Defense Research and Engineering. Its mission is to "develop, orient and, in connection with services or organizations in charge of scientific and technical research, coordinate research in the field of aeronautics."

The statutory texts concerning ONERA were modified in April 1963 in the light of two new considerations: the appearance of space research and the reorganization of the Defense Ministry itself, in particular the creation of the Directorate for Research and Testing Facilities (DRME) now the Directorate of Armament Research Studies and Techniques (DRET) whose coordinating and orienting action was placed in broader framework of the defense field as a whole.

Concerning the first point, it was stated that ONERA (the "A" in whose name was changed from "aeronautical" to "aerospace") "in connection with CNES (the then newly founded Space Agency), contributes, by its own action and through research agreements, to the development of research and experimental projects in the space field, mainly for defense applications."

In the framework of decentralization of the Ecole Nationale Supérieure de l'Aéronautique et de l'Espace (ENSAE), ONERA took charge of the Toulouse Research Center (CERT) with a staff of some 240, attached to this school, in 1968.

The Lille Institute of Fluid Mechanics (IMFL), a research institute with a staff of around 100, was attached to ONERA by a 1983 decree.

In 1984, after confirming the traditional mission of ONERA, (aerospace research and technical support for the national industry), a decree of January 11 restated this mission by asserting the role of ONERA in definition and development of computation facilities, promoting of research (possibly outside the aerospace field) and training of researchers.

2. Facilities

ONERA employs some 2,100 people (including the CERT and IMFL), of whom more than two-thirds are engineers and technicians. Its plants are located:

- In the Ile-de-France region: at Chatillon-sous-Bagneux (headquarters and main laboratories), Chalais-Meudon (research wind tunnels), Palaiseau (research facilities for energetics);
- Modane-Avrieux (large industrial wind tunnels);
- In the Toulouse region: CERT and Le Fauga-Mauzac Test Center. This center which is to receive the new large testing facilities will play a growing part in research in the aerodynamic and propulsion fields;
- Lille (in particular flight mechanics and structural mechanics facilities).

3. Organization

By application of the January 11, 1984 decree, general management of ONERA is ensured by the Chairman of the Board. The Chairman is assisted by a High Scientific Committee and a Scientific and Technical Committee.

The organization and functioning of ONERA were specified by a second decree of January 11, 1984.

The Chairman of ONERA prepares the research and development programs and technical investment programs. This preparation is within the framework of the general guidelines given by the Minister of Defense, in consideration of the scientific policy proposed by the High Scientific Committee. The Chairman carries out this preparation with the DRET Director, associating the Government agencies and organizations concerned, in particular those of the Direction Générale de l'Aviation Civile (General Directorate for Civil Aviation, the French equivalent of U.S. FAA or British CAA). After consulting with the Scientific and Technical Committee,

these projects are submitted to the approval of the Board before being adopted by the Ministry of Defense (Délégation Générale pour l'Armement—Ministerial Delegation for Armament).

The Chairman directs the scientific and technical activity of ONERA, supervises execution of the programs and the study or research orders placed by outside public or private organizations, and prepares the budgets.

He is assisted by a Secretary General who replaces him in case of absence or inability, by a General Scientific Director and a General Technical Director.

The General Scientific Director is responsible for preparing definition of the long range scientific policy of ONERA and ensuring insertion of the programs in the framework of this policy. He is the Chairman of the Scientific and Technical Committee.

The General Technical Director coordinates the activities of the operational departments (Systems, Aerodynamics, Energetics, Materials, General Physics, Structures, Large Testing Facilities, Computer Science). He is assisted by a Director for Military Applications, a Director for Programs and Infrastructure, a Director for Aeronautical Applications and high-level engineers to coordinate the activities conducted in certain sectors.

The General Inspector, in addition to his functions as inspector and adviser, coordinates all the scientific and technical relations on an international scale.

The heads of the Modane-Avrieux and Le Fauga-Mauzac centers are under the authority of the Director of the Large Testing Facilities.

4. Mission

ONERA contributes to progress in aerospace techniques with its fundamental research, complementing university laboratories, with its applied research, preparing long- and medium-term projects; and with its direct technical assistance to industry, either by making the testing potential of its centers available or by studying problems raised by actual projects under development or difficulties encountered on operational equipment. Thus, ONERA serves as a link between scientific work and aerospace manufacturers' programs in the design and production stage, whether for civil or military use.

ONERA's activity covers many fields, as the solution of the difficult and varied problems raised by aircraft and spacecraft design involves multiple disciplines and techniques, some of which lie outside the traditional aerospace area (data processing, solid state physics, coherent optics); conversely, the results often find applications in areas more or less far removed from their initial purpose.

ONERA works in close cooperation with similar establishments sponsored by other Government branches or covering neighboring or complementary disciplines. Its scientists keep up constant scientific contact with their colleagues abroad, particularly within the framework of AGARD, the NATO Advisory Group for Aerospace Research and Development. ONERA takes an active part in cooperative studies with various foreign and multinational (especially European) establishments and organizations. It stays in very close touch with French aerospace manufacturers, both at the level of its Board and Scientific and Technical Committee and that of its different offices and engineering teams.

ONERA protects some of its findings through patents, with a view to helping French industry in high technology fields. Patents are filed jointly with industrial companies whenever these take part in development. Research results are made available to industry as a whole, by an engineer reporting to the Director of Economic and Financial Affairs.

Licenses are sometimes granted to foreign firms, but priority is given to the rights of French industries already granted licenses of the same nature.

II. Management and Administration

Table 1. Budget

<i>a) Current Expenses</i>		
NET OPERATING FUNDS	million francs	percent
Ministry of Defense funding	362.6	38.0
Ministry of Research contribution	9.7	1.0
Contracts	569.1	59.5
Other proceeds	14.6	1.5
Total	956.0	100
USE OF THE ABOVE FUNDS (breakdown of activities by application)		
Aircraft, helicopters and aeronautical equipment		41.9
Turbomachines		10.5
Strategic and tactical missiles, military systems		29.3
Space		7.6
Non-aerospace studies		1.0
Multi-purpose studies		9.7
<i>b) Investments</i>		
Ministry of Defense subsidies	65.0	54.0
Ministry of Transportation (DGAC) contribution	8.0	6.6
Contribution of Regions	3.2	2.6
Self-financing (depreciation and reserve for investment)	34.5	28.6
Contracts (including construction of equipment left at the disposal of ONERA)	9.9	8.2

Table 1. Budget

<i>a) Current Expenses</i>		
NET OPERATING FUNDS	million francs	percent
Total	120.6	100
USE OF THE ABOVE RESOURCES (breakdown of program funding per center of activity)		
Test centers:		
Chalais-Meudon		9.7
Palaiseau		6.6
Modane-Avrieux		18.8
Le Fauga-Mauzac		10.3
Laboratories:		
Chatillon		28.8
Toulouse Research Center		8.4
Lille Fluid Mechanics Institute		9.4
General facilities		8.0

Table 2. MANPOWER (Average staff in 1986)

<i>By sector of activity</i>	
Systems	170
Aerodynamics	180
Energetics	185
Materials	107
General physics	158
Structures	116
Large Test Facilities	319
Computer Facilities (excluding CERT and IMFL)	53
Common technical staff (SAT + TNE)	224
Executive and common administrative staff	243
CERT	244
IMFL	108
Grand total	2107
<i>By plant</i>	
Chatillon	1063
Chalais-Meudon	243
Palaiseau	163
Modane	216
Le Fauga	70
CERT	244
IMFL	108
Total	2107
<i>By category</i>	
Engineers and executive	949
Draftsmen, staff supervisors, technicians	715
Workers	135
Clerical staff	308
Total	2107

III. OPERATIONAL DEPARTMENTS

Operational Departments per Sector of Activity

Systems

Scientific Director	Marcel Bismut
Deputy Director	Jacques Dorey
Scientific Assistant	Christian Marchal
Technical Assistant	Jacques Denis
Aerospace Mechanics	Jean Fave
Senior Scientist	Claude Aumasson
Thermophysics	Daniel Balageas
Electronic Systems	Gerard Garnier
Optronics Systems	Rene Jalin
Systems Experiments	Jean-Claude Theodore

Aerodynamics

Scientific Director	Claude Capelier
Deputy Scientific Director for Applications	Bertrand Costes
Deputy Scientific Director for Research	Henry Viviani
Scientific Assistant	Otto Leuchter
Technical Assistant	Pierre Weber
Theoretical Aerodynamics 1	Philippe Morice
Theoretical Aerodynamics 2	Yves Morchoisne
Theoretical Aerodynamics 3	Jean-Claude Le Balleur
Applied Aerodynamics	Bernard Monnerie
Fundamental Aerodynamics	Jean Delery
Experimental Aerodynamics	Jean-Pierre Chevallier
Senior Scientists	Colmar Rehbach, Jean-Louis Solignac, Jean-Pierre Veuillot

Energetics

Scientific Director	Serge Boudigues
Deputy Director	Pierre Larue
Deputy Scientific Director, Turbomachines	Pierre Duban
Deputy Scientific Director, Chemical Propulsion and High Temperatures	Paul Kuentzmann
Scientific Assistant	Pierre Duban
Technical Assistant	Yves Le Bot
Special Assistant, Gas Turbines	Yves Ribaud
Modeling and Numerical Simulation in Energetics	Francis Hirsinger
Compressor and Turbine Aerodynamics and Aerothermodynamics	Georges Mauze
Gas Turbine Combustors and Combustion	Andre Mestre
Ramjet Propulsion	Pierre Berton
Space Launch Vehicles and Liquid Propellant Engines	Daniel Lourme
Solid Propellant Engines	Lionel Nadaud
Basic Energetics Research	Guy Lengelle

Energetics

Prospects in Energetics	Pierre Laval, Guy Lengelle
Senior Scientists	Pierre-Jacques Michard, Claude Verdier

Materials

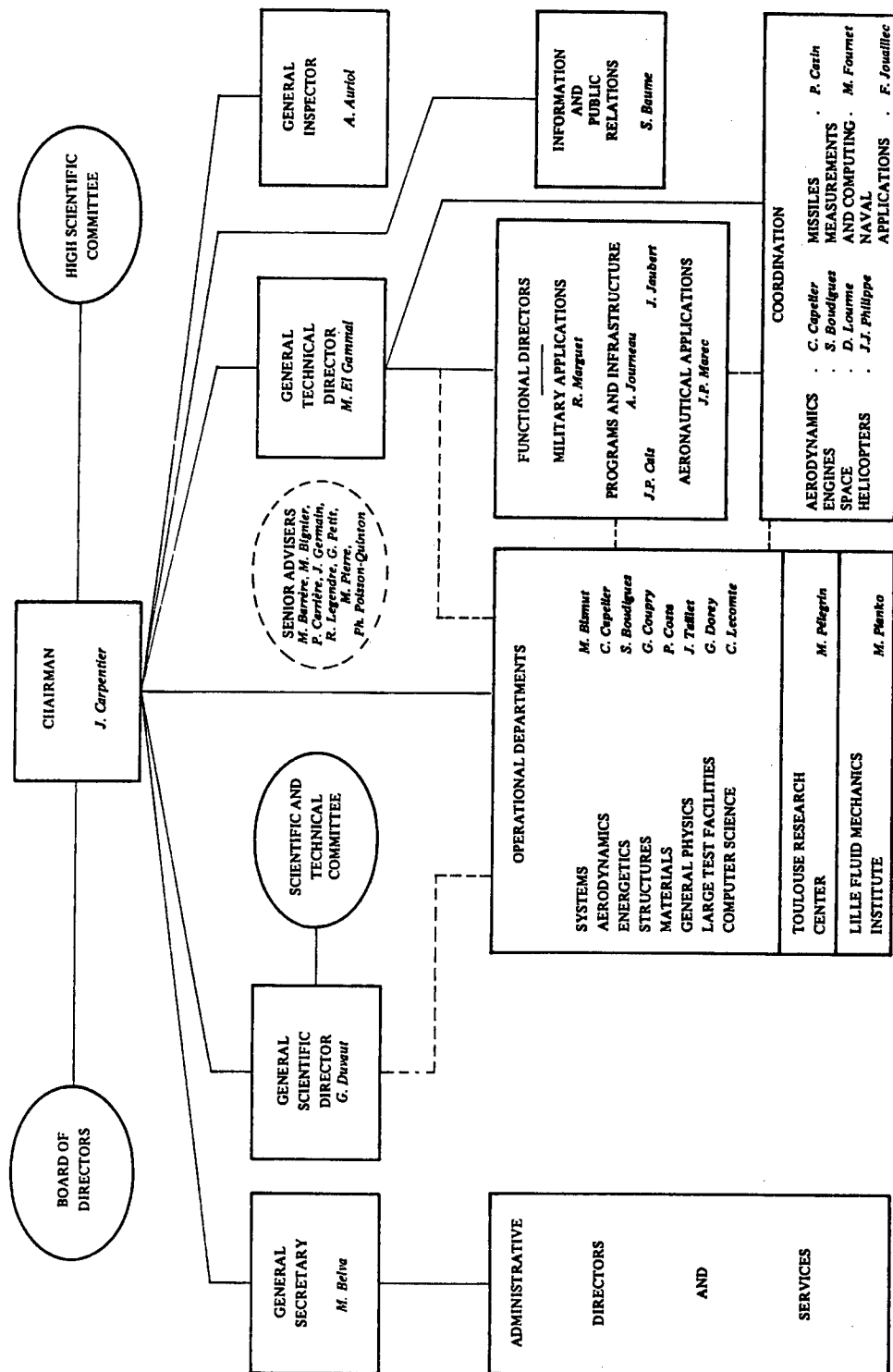
Scientific Director	Paul Costa
Deputy Scientific Director	Robert Pichoir
Scientific Assistants	Jean-Francois Stohr, Francois Girard
Physical Methods	Bernard Daigne
Ceramic and Ablative Composites	Jean Jamet
Senior Scientists	Bertrand Bloch, Francois Ducastelle
	Tasadduq Khan, Alain Lasalmonie

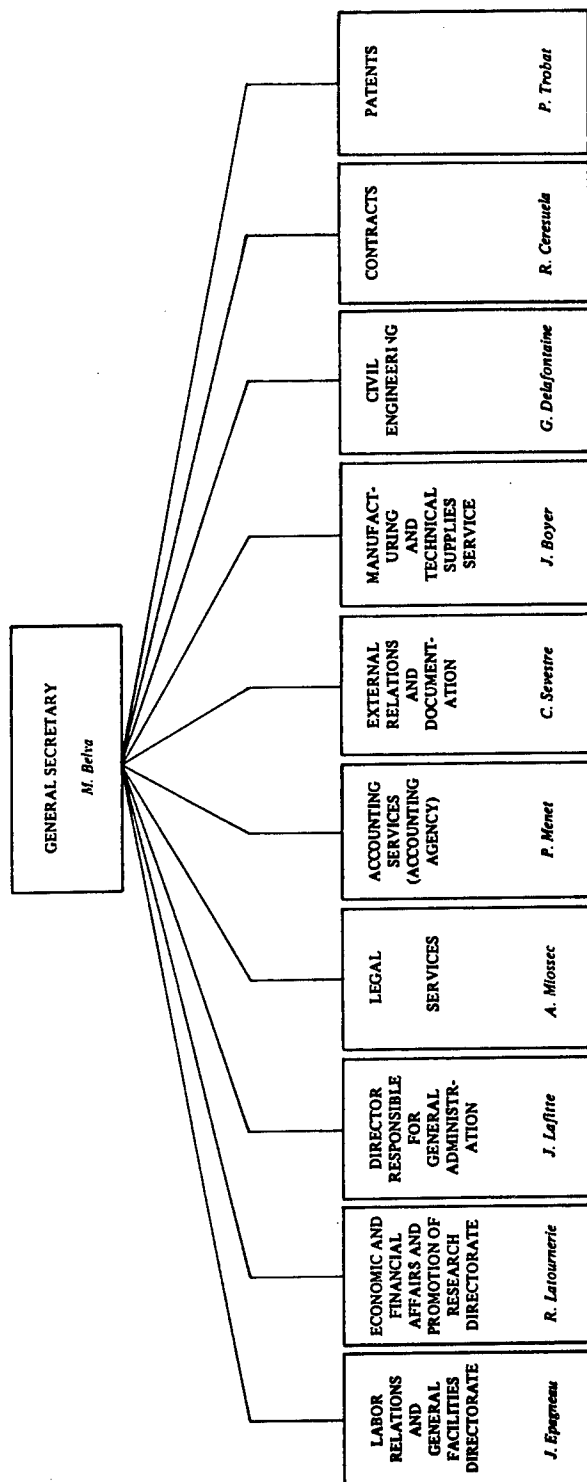
Structures

Scientific Director	Gabriel Coupry
Deputy Scientific Director	Rolland Dat
Deputy Scientific Director for Structural Calculations and Fatigue and Failure Analysis	Roger Labourdette
Scientific Adviser, Aeroelasticity	Jean-Jacques Angelini
Scientific Adviser, Industrial Developments	Henri Loiseau
Technical Assistant	Jean-Pierre Chaquin
Mechanics and Structural Calculations	Roger Ohayon
Ground and Flight Vibration Tests	Gerard Piazzoli
Wind Tunnel Model Tests	Roger Destuynder
Environment	Alain Bourguine
Special Tests	Edmond Szechenyi
Strength-Fatigue	Jean-Louis Chaboche

Physics

Scientific Director	Joseph Taillet
Deputy Director	Daniel Lepine
Scientific Assistant	Andre Girard
Technical Assistant	Jean Besson
Special Assistant	Claude Veret
Electronics and Measurements	Jean Appel
Senior Scientist	Jacques Beaussier
Optics	Jean-Claude Fontanella
Acoustics	Gerard Fournier
Quantum Optics	Jean-Pierre Taran
Senior Scientist	Daniel Pigache
Aerospace Environment	Jean-Louis Boulay





Large Testing Facilities

Director	Gerard Dorey
Deputy Director - Testing	Jacky Leynaert
Deputy Director - Engineering	Jean Christophe
Programs	Christian Soulier
Modane - Center Head	Jean Laverre
Modane - Tests	Claude Armand
Le Fauga-Mauzac - Center Head	Jean-Marie Carrara

Computer Science

Scientific Director	Claude Lecomte
Deputy Director - Computer Research	Michel Enselme
Computer Center	Jean-Pierre Peltier
Logistic Deputy	Guy Hanuise
Production	Jean Erceau (interim)
Liaison	Jacques Zeyons
Implementation	Georges Stalin

IV. Patents

1. Unclassified Patents Filed in 1986

A. Aerodynamics

E.N.86.14.722, October 23, 1986—Improvements Made to Air Propellers, in Particular for Aircraft Propulsion Systems. Invention of Jean-Marc Bousquet and Alain Faubert.

Hubcap for high-speed multiblade propeller. The special profile of the hubcap slows down the air flow at the blade root to avoid stagnation of the flow.

E.N.86.14.826, October 24, 1986—Improvements Made to Air Propellers, in Particular for Aircraft Propulsion Systems. Invention of Jean-Marc Bousquet, Alain Faubert, Georges Vingut.

High-speed multiblade propeller whose blades are defined by a mean curved line contained in a plane set with respect to the plane of rotation.

E.N.86.09.379, June 27, 1986—Automatic Air Intake, in Particular for Aircraft Engines. Invention of Francois Falempin and Claude Sans.

“Automatic adaptation” apparatus modifying the geometry of the air intake using the difference between the pressure on the compression ramp and the static pressure of the flow in the boundary layer trap.

E.N.86.11.269, August 4, 1986—Improvements Made to Propulsion System Nozzles To Reduce Lateral Loading. Invention of Anne Venables, Dominique Regard and Gerard Laruelle.

The sudden unsteady separations occurring in nozzles with a high ratio between cross-sections during pressure buildup in the engines are eliminated by obstacles of revolution located on the nozzle wall. The shape and nature of these obstacles stabilize the flow for the required time and disappear by ablation.

B. Energetics

E.N.86.02.653, February 26, 1986—Method and Generator to Generate Atomic Iodine in Ground State and Chemical Iodine Laser Using it. Invention of Claude Verdier, Bruno Leporcq, Eric Georges and Roger Barraud.

The invention concerns an atomic iodine generator for chemical iodine lasers. The iodine atoms in ground state required to generate the laser emission are produced by thermal dissociation of an iodine compound in gas phase.

E.N.86.17.737, December 18, 1986—Heat Exchanger with Spiral Exchange Circuits, Ribbed Plate for Such an Exchanger. Invention of Serge Boudigues and Andre Pelissier.

The innovation resides in the shape of the exchange plate. The plate and ribs on each side are located in the extension of each other and ensure 90 percent of the heat exchange by thermal conductivity. The fluid can be distributed in several channels defined by the ribs. The number, spacing, shape and height of the ribs allow selection of Reynolds and Mach numbers to optimize the heat exchange coefficient.

C. Materials

E.N.86.01.604, February 6, 1986 (filed jointly with Armines-Snecma-Imphy)—Nickel Base Superalloy Produced in Particular by Powder Metallurgy and Turbomachine Disk Made of this Alloy. Invention of Didier Lestrat, Bernard Paintendre, Christian Ducrocq, James Davidson, Michel Marty, Andre Walder.

New composition defined taking into account the effect of gamma emitting elements (Al, Ti, Nb), boron and hafnium on the structural and mechanical properties.

E.N.86.03.014, March 4, 1986 (filed jointly with Frechin)—Improvements Made to the Methods for Producing Metal Fiber-Base Materials and to the Materials Thus Obtained. Invention of Isabelle Gossard, Pierre Josso, Andre Walder, Claude Duret-Thual, Lucette Frechin and Pierre Lepetit.

The material is made by cutting up wire pads. The short fibers thus obtained are nickel-plated and coated with chromium and aluminum to guarantee good high-temperature resistance. The invention applies to the production of abradable seals, gas filters and catalyzer supports.

E.N.86.08.068, June 4, 1986—Single Crystal Nickel Base Superalloy, in Particular for Turbomachine Blades. Invention of Tasadduq Khan, Pierre Caron, Jean-Louis Raffestin.

Low-density superalloy derived from the composition of ONERA patent 83.18.421. The vanadium has been eliminated. The creep strength is improved.

E.N.86.16.841, December 2, 1986—Electrochemical Surface Treatment Method for Carbon/Carbon, in Particular Carbon Fibers Treated by this Method and Composite Material Including Such Fibers. Invention of Manuel Sanchez, Georges Desarmot and Blandine Barbier.

Nitrogen containing groups are grafted on the surface of the carbon by immersing the material in an electrolyte consisting of a nonaqueous solution of an amine compound in a dipolar solvent. The method is applied in particular to treating the surface of carbon fibers to be used in the manufacture of composites to improve the adhesion of the organic resins.

D. Metrology

E.N.86.00.061, January 3, 1986—Method for Calibrating a Radiofrequency Instrument and System Implementing this Method. Invention of Florent Christophe.

System for remote measurement of the coupling between the transmission antenna and the reception antenna of a radar transponder operating as an amplifier. The reception antenna is irradiated by a radiofrequency signal and the coupling is determined in real time by a microprocessor which compares the amplitude and phase of the retransmitted signal for several amplifier gains.

E.N.86.10.563, July 21, 1986—Weighing Apparatus with Capacitive Film Sensor. Invention of Michel Portat.

The apparatus uses a flexible dielectric (film sensor) whose resistivity varies according to stress. It is used for industrial weighing and metering.

E.N.86.14.320, October 15, 1986—Apparatus for Detecting the Presence and/or Measuring the Thickness of Ice by Ultrasounds and Icing Probe for Use in Such an Apparatus. Invention of Alain Deom, Jean-Claude Garnier and Didier Guffond.

The apparatus includes a probe equipped with an icing sensor adapted as required for detecting the presence or measuring the thickness of ice. The invention applies to detection of ice on aircraft and roads.

E.N.86.17.718, December 18, 1986—Ultrasensitive Accelerometer Calibration Apparatus. Invention of Alain Bernard and Pierre Touboul.

The invention is used to very accurately characterize measuring instruments sensitive to accelerations in orbit or on the ground, such as ultrasensitive triaxial capacitive accelerometers. The apparatus includes pairs of balanced wheels on three orthogonal axes, which generate sinusoidal accelerations in translation and rotation.

E.N.86.17.898, December 19, 1986—Capacitive Dimensional Measuring System. Invention of Alain Bruere and Claude Galaud.

Very high accuracy measuring system applicable to capacitive measurements of the clearance between the mobile blade tips and the stator of a turbomachine in operation.

E. Signal Processing

E.N.86.03.943, March 19, 1986—Decoy Method for a Sonar or Radar Detector and Decoy Implementing this Method. Invention of Dominique Medinsky.

A transponder outputs decoy signals designed to protect targets attacked by a missile equipped with a detection system as per patent 86.03.944 below. The signals transmitted by the missile and received by the transponder are transmitted after being amplified and delayed according to random patterns then added to noise.

E.N.86.03.944, March 19, 1986—Method and Apparatus for Remote Target Discrimination. Invention of Dominique Medinsky.

The invention concerns sonar and radar counter-countermeasure systems. The decoy signals transmitted by jammers or transponders and those backscattered by real targets are identified by determining the regression line of the average autocorrelation function of the detected signals and by identifying the real targets according to parameters related to this regression.

E.N.86.10.091, July 10, 1986—System for Detection and Location in Space of Lightning Discharges by Real-Time Very Remote Interferometric Measurement. Invention of Philippe Richard, Andre Soulage and Jean Appel.

Data processing system built around a digital computer which determines the space coordinates of the electromagnetic sources associated with the lightning discharges from their angular positions supplied by radiofrequency interferometers located in a region to be protected.

E.N.86.11.137, July 31, 1986—Method and Apparatus for Detecting the Appearance and Disappearance of Atmospheric Electric Phenomena Related to Stormy Conditions. Invention of Alain Delannoy and Pierre Laroche.

Variant of the method as per patent 86.11.138, involving additional data to reduce the alarm duration to a strict minimum.

E.N.86.11.138, July 31, 1986—Method and Apparatus for Predicting the Evolution of Atmospheric Electric Phenomena Related to Stormy Conditions. Invention of Alain Delannoy and Pierre Laroche.

Method for processing the signals supplied by electric field sensors located around a site to be protected, in order to predict the evolution of stormy conditions in order to trigger alarms.

E.N.86.11.550, August 8, 1986—Active Radiofrequency Transponder Capable of High Amplification. Invention of Gerard Garnier and Roger Kete.

Very high gain perfected transponder amplifier for radar systems.

E.N.86.15.250, November 3, 1986—System for Processing Signals in Noise and Its Application to the Fringe Laser Velocimeter. Invention by Jean Appel.

This system uses a new autocorrelator to extract from noise short duration transient signals whose times of appearance are unpredictable in real time. The invention applies in particular to measurement of the instantaneous velocity of fluid flows.

F. Miscellaneous

E.N.86.05.459, April 16, 1986—Machine for Cutting Sheets of Variable Lengths from a Strip of Printable Material or Similar. Invention of Fernand Suif.

Peripheral device for plotting tables and printers to automatically cut a strip of paper to the formats of the documents printed by the machine.

E.N.86.11.775, August 14, 1986—Aerosol Generator and Apparatus To Study the Flow of a Gas Stream. Invention of Jean Labbe.

Apparatus for generating submicronic aerosols to seed wind tunnel test sections for laser velocimetry. The standard capillary tube is formed by assembling two removable concentric parts, a center body in which is machined a spline and a sheath with ejection ports.

E.N.86.14.023, October 8, 1986—Laminar Flow Hood with Static Electricity Discharger. Invention of Serge Larigaldie and Joseph Taillet.

The static electricity discharger consists of a sheet of conductive wires installed on an insulating frame. Every other wire has an insulating sheath. The bare wires and the insulating wires are connected to the terminals of an AC power supply such that a flux charge of both polarities occurs in the laminar flow by corona discharge.

E.N.86.16.902, December 3, 1986—Isostatic Four-Point Support. Invention of Jacques Coste.

The geometry of the support is such that it distributes the load on the four stands. The supporting surface can be uneven, not flat and soft. The invention applies to platforms, guywire, suspension and handling systems and to furniture.

2. Patents Issued Abroad in 1986

West Germany

2 636 329—Miniaturized dielectric temperature probe
2 816 425—Potential discharger in particular for aircraft
2 945 688—Polyphase metallic systems of the NbC type with improved structural stability
3 147 011—Improvements made to electrostatic accelerometers
MU 84 94 082.3—Apparatus for forced jettison of external loads on aircraft

Australia

549 206—Ceramic composite materials

Canada

1 201 279—Ceramic composite materials

United States

4 563 125—Ceramic blades for turbomachines
4 566 328—Accelerometers with electrostatic suspension
4 579 546—Dual beam radiometers
4 583 404—Accelerometers with electrostatic suspension
4 589 740—Deformable retroreflecting trihedral reference systems
4 601 874—Titanium base alloy processed by powder metallurgy
4 622 816—Supercharger turbocompressor with variable blade setting

Spain

535 353—Automatic guidance system for self propelled

Europe

102 874—Bath for chemical deposit of nickel and/or cobalt using a boron or phosphorus base reducing agent
051 006—Method for neutralizing electrostatic charges by transfer of charges of opposite sign

Great Britain

2 132 703—Ceramic blades for turbomachines
2 144 711—Active compliance articulated device

Italy

1 119 108—Method and apparatus for measuring the bonding strength of an adhesive
1 119 069—System for controlling the efficiency of the aerodynamic control surfaces of an aircraft in flight
1 119 483—Polyphase metallic systems of the NbC type with improved structural stability
1 125 974—Transparent organic material
1 133 586—Continuous electrolysis system

1 133 716—Vortex flowmeter

1 144 568—Method and apparatus for electrostatic dedusting of a gas

Israel

66 923—Ceramic composite materials

Japan

10 187—Miniaturized dielectric temperature sensor
1 307 628—Heat treatment to increase the life of monocarbide fiber alloy parts
1 310 081—Method and apparatus for electrostatic dedusting of a gas
1 644 622—Far ultraviolet spectrograph

Netherlands

179 533—Potential discharger for aircraft

Sweden

445 783—Surface resistivity meter
447 133—Heat treatment to increase the life of monocarbide fiber alloy parts

USSR

1 258 342—Method for neutralizing electrostatic charges by transfer of charges of opposite sign

Negotiations Continue on FRG Aerospace Industry Restructuring

Interview with Daimler Head

36980365 *Duesseldorf WIRTSCHAFTSWOCHE in German 17 Jun 88 pp 41, 43, 44*

[Interview with Daimler-Benz CEO Edzard Reuter, by Wolfram Baentsch and Friedrich Braeuninger: "First-Class Player"]

[Text] In order to enter into a commitment to the Airbus project and to MBB [Messerschmitt Boelkow Blohm], Edzard Reuter, chief executive officer of Daimler-Benz, demands prior political concessions in the form of a "competent European business structure." In an interview with WIRTSCHAFTSWOCHE, he explains his strategy for reorganizing the German aerospace industry.

WIRTSCHAFTSWOCHE: At the Daimler-Benz AG general stockholders' meeting on 1 July, company architect Edzard Reuter will be presented to the stockholders for the first time in the role of CEO. Which will be more prevalent: applause or criticism?

Edzard Reuter: We hope for both. After all, the basic purpose of the general meeting is for the stockholders to advise us and to present their views on questions of company policy. In this respect we clearly expect acknowledgement of what has been achieved in this company over the past year.

WIRTSCHAFTSWOCHE: Surely of greater interest are the prospects for the future, such as the role that you are destined to play in the restructuring of the German aerospace industry, as well as the Daimler-Benz's new involvement in MBB.

Edzard Reuter: Right now—and I am also thinking about the general stockholders' meeting here—we are clearly not far along enough to be able to seriously talk about or report on any involvement by our firm in MBB. Things are far too much in a flux, and the outcome is entirely uncertain. It is true that in conjunction with expanding the group it has been one of our basic goals and tasks to play a role in the European aerospace industry. To that extent, the talks that we are engaged in here are consistent and completely in line with what we have been pursuing from the very outset.

WIRTSCHAFTSWOCHE: It has always seemed to us that a great deal of unintended momentum has been gathered in this regard.

Edzard Reuter: There will definitely never be any sort of momentum such that we allow external developments to impose on us something that we ourselves do not want.

WIRTSCHAFTSWOCHE: And yet the strenuous dealings surrounding MBB apparently have a different quality than your previous, nearly impassioned involvement at Dornier. Perhaps you have invoked spirits of which you can no longer rid yourself?

Edzard Reuter: Rest assured that that is totally wrong. We were and continue to be of the opinion that a sensible restructuring of the German aerospace industry against the background of European developments is called for. The reality of Europe 1992 is in fact a new dimension. That dimension did not exist when we decided on the previous new business ventures. We did not invent this new development, but we do affirm it and we are ready to actively participate in talks. However, we will not allow anyone to force an unreasonable solution on us.

WIRTSCHAFTSWOCHE: Bonn is apparently offering to eliminate all Airbus risks for Daimler-Benz. Is this because everyone else who has been considered for an industrial leadership role at MBB has already declined?

Edzard Reuter: Perhaps all the interested parties have in the meantime recognized that the Airbus project, which is in and of itself an outstanding one, will in fact require much more time to truly find a self-sufficient niche on the market. It is not a question here of the success of the airplane per se, but rather whether we are able to find a European company structure that has never before existed. Without this precondition, a unified European Airbus company cannot feasibly exist. For that reason, political work must be accomplished, and that clearly takes longer than envisaged.

WIRTSCHAFTSWOCHE: Could you explain what is lacking in clearer terms?

Edzard Reuter: Thus far, there has never been a company under European law. In German terms, Airbus Industrie is organized like a corporation under civil law, in which private enterprises as well as governments and mixed companies are involved. This loose structure requires that four governments make unified decisions every time. That is the exact opposite of a free, private-sector economic unit with the authority to act on its own, i.e., an enterprise. These prerequisites must be created at the outset. Thus, it is not primarily a problem that can be solved by the private sector; rather, it is the political question of whether it will be possible for Europe to become competent in this area.

WIRTSCHAFTSWOCHE: Apparently you are in good spirits, and you want to enter into negotiations concerning an interest in MBB. So first you create the structures and then graft on the strategy?

Edzard Reuter: Not at all. We clearly have our own ideas about meaningful strategies in this sector, which unfortunately can only be described with the English word aerospace: thus, aviation, space and those areas of defense that are inseparably linked with them. This strategy must be set up with an orientation towards Europe, but also towards cooperation with trans-Atlantic partners. That is why we feel that the structural reorganization of this industry is so necessary, and the federal government has thus far been with us in recognizing this.

WIRTSCHAFTSWOCHE: What concessions from Bonn do you still expect in order to assume the industrial leadership role at MBB

Edzard Reuter: The talks about that are still going on. The federal government has made a clear decision in favor of manned space travel in conjunction with the Columbus and Hermes projects. The second precondition—the desire to continue to be active in the realm of military aviation—has been fulfilled by the government agreements on the antitank helicopter and the Jaeger 90 fighter aircraft. The third premise—the one that we are talking about right now—is that we cannot assume any commitments and risks in conjunction with the Airbus project until this program is complete and a competent European corporate structure has been found for it.

WIRTSCHAFTSWOCHE: With MBB, it is the Laender, and not the federal government, that have say. Who should wrap up the MBB package for you?

Edzard Reuter: The federal government or one or more of the current MBB stockholders. At any rate, we feel that it is inconceivable that we would now run around the German countryside knocking on every door and

asking, 'What set-up would you like to see?' In a situation that is this complex and complicated, you have to have one or two authoritative discussion partners on the other side of the table. Otherwise it is not at all feasible.

WIRTSCHAFTSWOCHE: How do you intend to exercise industrial leadership if, for example, permanent guarantees are demanded for MBB production facilities and jobs in Bremen and Hamburg?

Edzard Reuter: What makes you think that we are talking here about industrial leadership by us? At any rate, there is no dissension between the interested parties with respect to the objective that the private-sector competence of this reorganized corporate group must be ensured. This naturally means that the management must also be free to take any structural steps whatsoever.

WIRTSCHAFTSWOCHE: Thus far, Mr Reuter, you have not achieved full discretion to take action at Dornier. Moreover, Dornier and MBB each regard the other as their most bitter competitor.

Edzard Reuter: We will have to discuss—regardless of in what constellation—the question of who will concentrate on what area. This is the only way that we in Germany can ever constitute the critical mass that is necessary to make it to the top in international business.

WIRTSCHAFTSWOCHE: The fact remains, however, that the aggravating underwriting contract with the Dornier family stockholders continues to tie your hands. How would you solve this problem?

Edzard Reuter: That contract was concluded at a time when European developments were not yet discernible and a smaller role was perceived for Dornier in the aerospace sector. The family stockholders feel that even in the new era, Dornier can remain a small, refined company. We believe that this is an erroneous assessment that misjudges international developments. We must come to an agreement on this difference of opinion on the basis of the underwriting contract and seek consensus in order to not have to take the matter to court...

WIRTSCHAFTSWOCHE: ... In court you would presumably be at a disadvantage...

Edzard Reuter: ... Are you a lawyer?

WIRTSCHAFTSWOCHE: Well, the little Civil Code is enough to see that.

Edzard Reuter: I have the big one, and am not at all that devoid of confidence. No one in the company is even contemplating taking these problems to court. If, however, it should turn out—something that we hope will

not happen—that the family stockholders are putting their own selfish interests above those of the company, then we would certainly have to consider those possibilities as well.

WIRTSCHAFTSWOCHE: The Dornier heirs feel that they have been poorly treated by you in terms of information.

Edzard Reuter: No one should exonerate himself of all error. I certainly will not do that for myself. Clearly there have been communication problems in the past.

WIRTSCHAFTSWOCHE: Do you stick to your ultimatum that you will cancel plans for the Do 328 regional airplane if the family stockholders block the increase of capital?

Edzard Reuter: I hope that the current talks will be resolved positively. However, I still cannot imagine that Daimler-Benz could unilaterally make this increase in capital available while the constellation of stockholders remains the same. We are jointly involved in this company, and we bear the same responsibility for it. If it is not possible to reach an agreement in a situation such as this, then one must find a way to split up, for the sake of responsibility towards the company.

WIRTSCHAFTSWOCHE: Subsequently, the aerospace activities of AEG, MTU, Dornier and possibly MBB must be coordinated. Are you thinking about a separate executive department?

Edzard Reuter: Once it is possible to solve the corporate problems, moves in that direction will clearly be considered. But that is a long way off.

WIRTSCHAFTSWOCHE: What is your assessment of the danger of possible harm to your automobile business in the United States if Mercedes is linked to the subsidized Airbus via MBB?

Edzard Reuter: That is purely hypothetical. The discussion between the United States and Europe concerning who subsidizes whom more in the aerospace sector must stop. Ending this debate should be part of the efforts by the FRG government. I believe that these problems between the United States and Europe in the fight between Airbus and the U.S. aviation industry can be cleared up, at least in principle, before there is any sort of result of the Daimler/MBB negotiations.

WIRTSCHAFTSWOCHE: Lots of luck! There are in fact other risks for the image of your noble automobile inherent in your diversification policy. For example, flops in other corporate areas could result in problems for the Mercedes.

Edzard Reuter: This is certainly a danger, and we are giving a great deal of thought to possible ways to prevent it. It is less a real than a psychological hazard, caused by misjudgments of public perception. We must find ways to keep things clearly separate.

WIRTSCHAFTSWOCHE: Since your new public relations chief, Matthias Kleinert, has been in place, many observers have gotten the impression that Daimler has been overdoing things in this regard. Is this type of publicity to your liking?

Edzard Reuter: We are in the public eye now more than before. One cannot crawl away from this. Our work in this area, as you have already seen, is much more involved than was previously the case. It is embodied by a mentality that is best expressed in the person of Mr Kleinert. He is my closest colleague and enjoys my full confidence.

WIRTSCHAFTSWOCHE: And he is supposed to deal with the fact that there are considerable delays in the introduction of new models of automobiles?

Edzard Reuter: I don't know of anyone in the world in public relations who can speed up the start-up of new models of automobiles. We are on schedule and remain on schedule.

Government Subsidies

36980365 Hamburg DER SPIEGEL in German
4 Jul 88 pp 76-77

[Text] After long hesitation and intense haggling with the federal government, Daimler head Edzard Reuter is now willing to make a commitment to the Messerschmitt Boelkow Blohm aerospace group. Bonn is assuming the financial risks of the Airbus program from him. This week, the cabinet will decide on new subsidies totally millions of marks.

The minister of Finance resisted for a long time. Until last week, Gerhard Stoltenberg refused to add a new Airbus package amounting to several hundred million Deutsche marks to the 1989 budget. According to Stoltenberg, the subject was "not yet ready for the budget," due to the open negotiations with Daimler-Benz concerning that company's involvement in large-scale aircraft manufacture.

Despite the pressure applied by Bavarian Minister President and Airbus board member Franz Josef Strauss, Stoltenberg did not budge. When letters to the minister of Finance had no effect, the Bavarian bombarded Minister for Economics Martin Bangemann and Chancellor Helmut Kohl with mail.

"I would be grateful to you," wrote Strauss to Kohl, "if you would see to it that the necessary measures be taken by the federal minister of Finance in order to ensure the

survival of Deutsche Airbus GmbH." The federal government should once and for all—"and this should be made binding on the minister of Finance"—establish whether it is willing to stick to the goal of a self-sufficient European aviation industry. Strauss: "It makes no sense ... to continually switch to secondary theaters of the war such as the negotiations ... with Daimler-Benz."

On Tuesday, after his talks with Bangemann about the minister for Economics' budget, Stoltenberg finally realized this as well. Having been worn down, he suddenly declared Airbus "budget-ready"; the draft budget that the cabinet is due to approve this Thursday contains provisions for a crisp DM 400 million for the aircraft.

The minister of Finance has long been aware that he would not escape from the Airbus fiasco. Now, the attempt to gain at least a small negotiating advantage in the billion-mark poker game with Daimler-Benz through stalling tactics has failed as well. His ploy was spoiled not only by Airbus lobbyist Strauss, but also by his colleague in the cabinet, Bangemann, who has always loudly called for the dismantling of subsidies.

In the meantime, Bangemann's people have worked out a growth rate in the budget of the Ministry for Economics of around 40 percent. This is no cause for joy for the minister: The only increases have been in state funding for steel, coking coal and Airbus.

Bangemann's Free Democratic following is not willing to accept this development without protest. FDP budget expert Wolfgang Weng, who is still obviously irritated by the coalition's aviation fuel calamity, is threatening a pitched battle for the decision-making sessions this week: "We will be fighting back on Airbus."

And yet, the anger expressed by Weng, who is from Baden-Wuerttemberg, will clearly fall flat. That Airbus will not go wanting for money has long since been a given.

The details of Daimler-Benz's involvement scarcely play any role. With or without Daimler head Edzard Reuter, the minister of Finance is ultimately once again in the same hopeless situation with respect to all demands for Airbus: If he does not want to be known as the man who dealt the death blow to Airbus, then he must follow up the billions already spent on it with more of the same.

The impotence of the federal government is reflected clearly in the previous outcome of negotiations with Reuter: Martin Bangemann went in with the goal of convincing the Stuttgart automobile manufacturer, who is swimming in money, to invest in the Messerschmitt Boelkow Blohm (MBB) aerospace firm, in order to saddle industry with part of the burden of the Airbus risk. However, nothing came of this.

By the time Bangemann goes to Brussels in January, Daimler will probably be a partner in MBB. However, as long as no profits are in sight, Airbus will more than ever remain a ward of the state, fully dependent on it for nourishment.

Still, one high-ranking official is encouraged: "Daimler is not getting everything on a silver platter." However, Mercedes spokesman Matthias Kleinert draws a clear line and in so doing acts as if he is waving the banner of the independent enterprise: "We will not assume the risk for Airbus because we do not want to become a recipient of subsidies."

For nearly 20 years, Bonn has been supporting the European Airbus with many billions of marks. The taxpayer paid for the development of the first airplanes, the A300 and A310. He paid for the construction and assembly of the 150-seat A320 jet, of which initial deliveries to airlines began this year, and he is also paying for mass production.

This large sum of money is supposed to be returned to the federal treasury sometime, with profits added. It was in 1986, however, that Bangemann discovered the expression "old debts" for the supposedly profitable investments. Naturally, they must be fully assumed by the federal government.

In concrete terms, this means relinquishing repayment of the billions for development until the end of time, and gradually assuming a loan guaranteed by the federal government to the tune of DM 3.1 billion. It is from this pot that Airbus is paying for mass production.

Part of the 1.9 billion had already been accepted by Bonn, in the cabinet decision of 3 June 1987. The first installment for 1988, amounting to DM 200 million, has long since been signed over. Since it was professed that the guarantee was to be dismantled, the guarantee provisions that Airbus can claim would have had to be lowered immediately after the transfer to DM 2.9 billion.

However, that is not how things work with subsidies. Airbus had spent the 200 million and taken on another 200 million, naturally again guaranteed by the government. If the government drastically reduces the volume of credit for Airbus through allowances, as Strauss wrote to Kohl in 1986, "the guarantee... can continue to be used as a protection against risk."

In order to draw Daimler into MBB, the rest of the old debts, totalling 1.2 billion, are now due following this pattern, linked with an exchange rate hedge for the A300, A310 and A320 programs up to a dollar rate of DM 1.60. The programs are calculated at two marks.

State Secretary for Economics Erich Riedl estimates in the budget committee that if the dollar stays 10 pfennig under this level, then it will cost around DM 470 million until 1994 for the A300/310 alone, and around DM 570 million until 2000 for the A320. At present, the dollar is around DM 1.80.

After this was settled, the executives and ministry officials deliberated on the form of involvement in MBB in terms of corporate law. An agreement has in the meantime been reached on this point as well.

The MBB capital stock is being increased by a shot in the arm by Daimler of around a billion marks to such an extent that the Stuttgart company will then have a 30 percent investment. The share held by Hamburg, Bavaria and Bremen drops from around 50 percent to approximately 36 percent.

Together with the other industrial stockholders, Daimler would be in charge at MBB after this operation. The Stuttgart company, already the decisive force at the number two aerospace group, Dornier, could then reorganize this industry however it wishes and do profitable business with the fixed state contracts for the Jaeger 90 and the Ariane V, Hermes and Columbus space projects.

The only dilemma is this: MBB has a 100 percent subsidiary on behalf of Airbus, and Daimler must take it over as well, for better or for worse. The only thing is that it cannot cost anything.

For this reason, the parent company and the subsidiary are being transformed into joint stock companies between which there is no surrender of profits agreement—an explicit condition set by Reuter. The losses suffered by the Airbus subsidiary will not be assumed by MBB; that remains the business of the federal government, which for the first time will have a 15 percent share in Airbus itself. Naturally, even with this arrangement the government could refuse to assume the losses on purely legal grounds. However, this idea is again subject to the old rule: That would be the end of Airbus, and no one can accept responsibility for that.

To at least maintain the appearance that Daimler is assuming a hint of responsibility for Airbus in the future, Bangemann and Stoltenberg are turning their sights away from the ugly old debts and towards the future. Now, there is the A330/340 jumbo jet, which was approved last year.

Bonn, of course, is financing the development costs. According to the cabinet decision, this involves DM 2.9 billion in supposedly repayable subsidies, as with the A300, A310 and A320.

But in the future, Bonn wants to have nothing to do at least with the mass production stage, which will cost as much as DM 3 billion. This should be covered by the

billion marks with which Daimler is buying into MBB. The money must be transferred immediately from MBB to the Airbus subsidiary. The company will borrow the rest from banks.

In addition, the minister of Finance is requiring that Daimler at least share in the foreign exchange risk for the A330/340. With a dollar rate of DM 1.80, this airplane has been calculated somewhat more cautiously than the older members of the Airbus family. Stoltenberg is thinking that Daimler should have a one-third share in the foreign exchange risk.

However, it is precisely these two points—the use of the MBB entry price of one billion marks and the company's share in the foreign exchange risk—that are still open. At the Daimler general stockholders' meeting last Friday, Reuter seemed confident that he would reach an agreement with Bonn. He would like to leave part of his billion marks in MBB, and he wants to leave the foreign exchange risk on Bonn's shoulders.

That is probably what will happen. If Bonn does not give in to Daimler's conditions, then Stoltenberg—according to the applicable ground rule—will have to pay, unless he topples Airbus. "That's what happens," according to a member of the CDU executive committee, "when an unsuspecting minister for Economics negotiates with an insistent Strauss and a hard-line Edzard Reuter."

Cartel Office Veto

36980365 Frankfurt/Main FRANKFURTER
ALLGEMEINE in German 7 Jul 88 p 7

[Text] Bonn, 6 Jul—The chairman of the Antitrust Commission, Prof Ulrich Immenga, has called greater involvement by Daimler-Benz in Messerschmitt Boelkow Blohm (MBB) undesirable. He believes that an arms corporation is clearly emerging here that would meet the criteria of market dominance. Immenga criticized the Federal Ministry for Economics, which apparently wants this merger. This also raises the question of what the advice from the Antitrust Commission to the Ministry should be. In principle, he said, it is unjustifiable for the state to assume the risks of business management from a company.

In its seventh main report, the Antitrust Commission has come out against the cartel amendment announced by the federal government. It comes at the wrong time, said the chairman, Prof Ulrich Immenga, Wednesday in Bonn. He added that competitive conditions do not require a special arrangement for commerce with respect to cartel law. Instead, Immenga called for a fundamental reexamination of the Cartel Act based on 30 years of experience and with due attention to fair trade regulations in the EC. This could be one task for the next legislative term, he said, but a new cartel amendment should not be passed now in a heave-ho manner.

Federal Minister for Economics Martin Bangemann said in a statement that developments in the retail food business in particular are the reason for limited corrections to the Cartel Act. It is also reasonable, he said, to strengthen competition in the exempted sectors. A similar view was expressed by deputy Matthias Wissmann, on behalf of the CDU/CSU Bundestag caucus. He said that the cartel amendment is urgently needed, and that the process of commercial concentration, the demand strength of large commercial enterprises as well as improper behavior necessitate legislative intervention. Although SPD deputy Uwe Jens does support the Commission's opinion to the effect that European merger control should be given high priority, he also believes that national measures cannot be held off until the completion of the EC internal market. The Federal Association of German Industry [BDI] attests to the commission's "sense of reality"; the BDI also supports European merger control. The Association believes that a clear division of responsibilities between the EC Commission and the national antitrust authorities should be ensured, whereby European law should have top priority.

The Antitrust Commission does not think that case-by-case intervention into the Cartel Act is necessary. The structural transformation in commerce is taking place under conditions of lively competition, it says; intensifying merger control in commerce, even while keeping in mind the spectacular mergers of recent years, is not appropriate. Changes would mean that control would start below the monopoly threshold. Also, the significance of this criterion to administrative policy has been repeatedly underscored by the federal government, the Commission said.

The Antitrust Commission also thought that it is wrong to consider relations between the market and the suppliers in deciding on a merger, since the procurement volume of individual commercial enterprises from a supplier cannot be a decisive criterion. Much more critical is the question of how much competition there is in the dealings. The Antitrust Commission sees the risk of forestalling or restricting competition in a move to intensify behavior control. This is true in particular of an attempt to declare a sale at cost price improper. Thus, the degree of market dominance should be the decisive criterion for behavior control. In the Commission's view, the cooperative alternatives for small and midsize companies are also adequate.

One element of modifying the exemption regulations is a reexamination of the sovereign regulations. If banks and insurance companies are included in the prohibition principle of the Cartel Act, Immenga said, then the public utilities should also be included. Among insurance companies, competitive impulses could be triggered by largely eliminating state intervention into premium schedules and insurance conditions. The interests of policyholders could be guaranteed by a bankruptcy safety fund and by improved solvency control within the companies.

12271

FRG: Association Formed for Aerospace Businesses

36980368c Duesseldorf *HANDELSBLATT* in German
6 Jul 88 p 12

[Article: "North Rhine-Westphalia Seized Initiative"]

[Text] Duesseldorf, 5 Jul (*HANDELSBLATT*)—ALROUND stands for a new "Action Group of Air- and Space-Oriented Companies in North Rhine-Westphalia." NRW-Minister of Economics Prof Dr Reimut Jochimsen invited firms headquartered in North Rhine-Westphalia to the founding of this new aerospace organization on 28 June 1988. ALROUND's objective is to support firms in their efforts to obtain better opportunities for access to collaboration on aerospace technology projects.

Representatives of nearly 100 firms from NRW attended the foundation meeting. Also represented were universities, technology centers, chambers of commerce and industry, and the German Research and Testing Facility for Aeronautics and Astronautics (DFVLR).

The first chairman of the founding board is Prof Dr of Eng. Wolfgang Schaefer, managing director of Schaefer Automation GmbH of Essen. Other members of the board include: Guido Baranowski, managing director of the Technology Center of Dortmund, GmbH, a center for material handling systems and materials technology, and Friedrich Karl Stock, managing director of CAE Electronics of Stolberg.

The headquarters is set up in the Founders and Innovations Center (GIZ), Eupener Strasse 150, 5000 Cologne, where Arno L. Schmitz from Koenigswinter, former managing director of the Federal Union of the German Aviation, Space, and Military Industries (BDLI), is acting as managing director.

Assistant Secretary Dr Mainberger, special consultant for aerospace for the Duesseldorf Ministry of Economics presented the interest coalition of NRW firms as an exemplary initiative of business for safeguarding the future of the region. Above all, the opportunities for smaller firms should be reinforced—along with the assumption of pilot functions by larger firms.

Dr Gerd-Peter Seidel, managing director of the MST Company Consultants GmbH of Cologne, gave a detailed survey of the possibilities for action primarily for small and medium-sized firms in the future aerospace market using selected examples from the space sector and especially from the infrastructure project now under preparation at the DFVLR in Cologne-Porz for the large space programs of the 1990's. ALROUND intends to provide practical help to the firms for participation in this.

12666

FRG Airbus Subsidies

36980368b Duesseldorf *HANDELSBLATT* in German
7 Jul 88 p 1

[Article: "No Agreement on 'Old Debts': Subsidies Greatly Increased"]

[Text] Bonn, 6 Jul (*HANDELSBLATT*)—The federal government intends to make DM524 million available next year for the Airbus project. Federal Minister of Finance Stoltenberg, Minister for Economics Bange-mann, and the federal government's coordinator for aerospace, Undersecretary Erich Riedl, reached agreement in Bonn to increase the DM200 million originally planned by DM324 million.

Funds to cover old debts and to protect against exchange rate risks are included in the draft budget which is to be adopted by the cabinet on Thursday. Intermediate-term assistance from the government for the Airbus project is to be discussed again at the end of July/beginning of August.

Assumption of the old debts and protection against risks are prerequisites put forth by Daimler-Benz for their participation in the Airbus partner MBB. The exchange rate risks have diminished somewhat since, at DM1.82, the current rate of exchange for the dollar is considerably closer to the rate of DM2 which would cover the Airbus business. The chairman of the board of MBB, Bavaria's Finance Minister Streibl, was not able to take part in the discussion in Bonn.

12666

Fifteen-Year FRG Hypersonic Transport Program

36980368a Frankfurt/Main *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT* in German
30 Jun 88 p 8

[Article: "The Technology for the Hypersonic Plane Must Be Developed First"; first paragraph is *FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT* introduction]

[Excerpts] Frankfurt—Ceramic materials will play the key role. Dornier proposes an alternative to the "Saenger" Design.

The fastest plane in passenger service is currently the French-British "Concorde". At an altitude of 15,600 meters, its cruising speed is 2,180 km per hour, or Mach 2.04. The Mach number expresses the ratio of the speed of a body to the speed of sound, 340 meters per second. Mach 1 at approximately 1,200 km per hour equals the speed of sound. Cruising speeds greater than Mach 5 are in the hypersonic range. All the large industrialized nations are already working on such planes. A fundamental expectation in this process is new solutions of problems for the aviation, military, and space sectors.

The production of a cost-effective and safe space transport system through international cooperation is an FRG priority. In a national program under the leadership of the Federal Ministry for Research and Technology [BMFT], industry, research institutes, and universities are working on solutions for an optimum overall design and on especially critical technological tasks as a preparation for international cooperation. The master design is the "Saenger II", a reusable two-stage space transport system with horizontal takeoff and landing capability proposed by Messerschmitt-Boelkow Blohm (MBB). Dornier has proposed an alternative design, currently being studied in depth for the BMFT.

In the realization of a hypersonic transport system, the development of the necessary technologies plays a key role. In three phases over a period of 15 years, the technical prerequisites for subsequent realization are to be generated. The current phase I (5 years) breaks down into in-depth design studies of the entire system and of the propulsion system and into so-called separate technology projects for the four major areas of propulsion, aerothermodynamics, materials/construction, and flight controls/systems. This phase is still strictly national.

Construction and initial trials of a demonstrator produced in Europe or transatlantically are the focus of phase II (7 years). The expansion of trials and the beginning of development for a complete system characterize phase III (3 to 5 years), at the end of which the competent decision for the realization of a hypersonic plane will be possible.

Chronologically subordinated to the Hermes project, the major technological problems are in the upper stage and in the integration of the upper and lower stages. Together, the two stages form a complex Mach-7 hypersonic system. As Dr Eckart Steinheil and Wolfgang Uhse of Dornier GmbH report in the company newsletter DORNIER POST, the air-breathing combination propulsion system presents the greatest challenge. Fundamental problems remain to be solved in the technological areas of aerothermodynamics and materials/construction before it is possible to evaluate how efficient and therefore how technically and economically justifiable the overall design is. In addition, issues of flight controls and the design of the individual systems, e.g. life support and secondary energy generation, must be included early on.

12666

BIOTECHNOLOGY

EC Commission Proposes Biotechnology R&D Program for Agriculture

3698m327 Bonn TECHNOLOGIE
NACHRICHTEN-PROGRAMM INFORMATIONEN in
German No 420, 18 Mar 88 pp 2-16

[Text] In this publication:

The EC Commission Proposes a first multi-year program (1988-1993) for biotechnological, agroindustrial research

and technological development, ECLAIR [European Collaborative Linkage of Agriculture and Industry Through Research]

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INTRODUCTION

The goal of the program proposed here is to contribute, on the intermediate and longer term, to the competitiveness of European agriculture and industry—see basic goals of the EC activities in the fields of science, technology and demonstration, in article 24 of the Uniform European Act—new title VI article 130F, part three of the EWG [EEC] contract through improving the relationship between these two basic areas of our economy. The commission proposes to transform this goal into reality through a pre-competitive research and technical development program.

The projects will be set up to promote the close cooperation between agriculture and industrial activities through research and technical development supported by the newest advances in natural sciences and biotechnology.

This proposal contains the basis for Community-wide action and opens a new phase in the steady development of Community activities in the field of biotechnology, as they evolved during the last five years, and especially according to the definition of Community policies pertaining to this problem—cf. KOM(83)328 "Biotechnology: The Task of the Community", 8 June 1983 and KOM(83)672 "Biotechnology in the Community", 4 October 1983.

With respect to the multi-year master program (KOM(83)516, Council decision regarding the Community Master Program in the Area of Research and Technological Development (1987-1991), 28 September 1987, ABL No L302, 24 October 1987), this specific program proposal corresponds to the area of activities which deal with the application and most advantageous utilization of biological resources.

In part A, the general background of the proposal is described, notably the strengths emanating from scientific advancement, the growing technological possibilities and challenges faced by industry and agriculture. The solution to this problem will require a mutual adaptation from European agriculture and industry notably through joint research and development efforts at the Community level. The proposed program represents a first phase of the longer term perspective.

In part B the proposed Community program is described, how it responds to these challenges by promoting R&D at the intersections of agriculture and industry. The specifics of the selected areas, the criteria for the selection of projects and the relationship to other planned or existing Community activities and R&D programs are specified. These programs are in many cases directed toward the development of horizontal technologies such as gene technology or enzymology. The present proposal is restricted to the development of systems which include the results of particular research studies and technological developments through further R&D. It has the two-fold goal of making new materials available for industry and creating new possibilities for the sale of agricultural products.

The program is slated to begin in the middle of 1988 and to last 5 years (mid-1988 to mid-1993). Estimated total cost will be at least 150 million ECU of which the amount to be assumed by the Community budget does not exceed 50 percent of each individual project.

PART A: BACKGROUND

1. Challenge of Biotechnology

1.1 Natural Sciences, Biotechnology: Forces for Change

Within the last decade, the natural sciences have led to a series of new discoveries of a fundamental character. These basic discoveries have resulted in applications which are promoted through competition. In some areas, these will develop slowly and gradually while in others they will progress with unanticipated rapidity. This is particularly the case in the areas of all activities which depend on biological systems and their self-creating parts and properties. Biotechnology is gradually increasing our understanding of genetics and the determining factors of certain characteristics thereby leading to the

possibility for a more rapid development and increasingly precise design of organic materials. These materials are better suited for the needs of the industrial market and the development of new consumer markets.

These discoveries in the realm of the planning stage can be supplemented through new, optimal methods, and the new scientific knowledge can be applied to old problems—such as the fight against pests and epidemics, animal nutrition and the control and improvement of harvesting and processing procedures.

Lastly, such developments will lead to decisive changes in land and forest management, in the food and drink industry, in parts of the chemical industry, in the area of pharmaceuticals and hygiene, in the treatment of water and waste products, and in the maintenance and improvement of the environment. They will lead to structural changes in all areas of economy. Thereby, they will gradually lead to a transition from non-renewable to renewable basic materials in certain economic sectors.

The timely marketing of these developments, on the other hand, will ultimately influence the relative economic strength of the particular commercial firms of entire nations and of trade zones such as the European Community.

Thereby the increasing availability of production possibilities in agriculture, enhanced by the current progress in scientific knowledge, creates the possibilities for new industrial activities. With its first class abilities in the biosciences and its strong economic branches (nutrition, fodders, chemistry, pharmaceuticals, fiber and wood products), and with the help of a Community-wide initiative, Europe can respond to the challenge by making the best possible use of these depicted possibilities.

1.2 Challenge to Science, Agriculture, Industry

The cooperation of science, industry and agriculture is needed in order to examine and exploit the new biotechnological possibilities and to respond to the competitive threats. This can be achieved through the development of new materials and products, the improvement of quality and use of the already existing products. Biological materials can be developed to a higher degree than mineral raw materials. They can be designed for our consumption.

Although scientific discoveries in the natural sciences have taken an astonishingly rapid course, a transfer into practical innovation will be slowed down by many obstructions, and the resultant changes in the trade structures and habits will also be slow. Measures on the part of the state in various areas of policy will influence the extent to which the different firms in Europe will respond to these challenges and arising changes.

Industry, as supplier or customer of the agricultural sector, is hesitant to invest in areas which are subject to state policies, intervention and controls. Community policies as well as national policies should adapt whenever possible in order to facilitate and promote the exploitation of the new possibilities, especially with respect to the increasing availability of known and potential agricultural raw materials.

The farmer cannot be expected to bear all the burdens and risks associated with the development of alternative market possibilities. He needs cooperation with industry in order to work out the new market possibilities and quality demands. After that he can attempt to adapt his production with the assistance of an industry, supplied with further developed plant equipment.

The scientist occupied with basic research or training, or with pre-competitive technologies, needs corresponding conditions, stimulation and co-workers from the commercial area so as to be able to transfer his research results into use by industry or agriculture.

The evaluation of the results expected from the proposed program will require considerable investment in a large market. Putting these investments into use through developmental projects based on cooperation within a joint program will make it easier to achieve this European dimension.

1.3 Community Strategy for Biotechnology

The Community has recognized the importance of biotechnology for a long time. It allowed for this importance first by the proposal for research in biomolecular technology (1976), then by the first FAST program (1978-1983), and subsequently in 1983 by the six priority measures presented in the following. Decisive advances have been achieved in the first five areas while no results are as yet available with respect to the last.

—**Research and Training:** The program involving biomolecular technology (1982-1986) was concerned especially with agriculture and nutrition. Decisive successes were achieved, for instance in plant genetics, the development of vaccines for animals and the enzymology for foodstuff production. With the current action program in biotechnology (1985-1989), these efforts are being continued and expanded.

—**Coordination:** This action brings information and support to those who are responsible for other policies pertaining to biotechnological areas. The coordination unit for biotechnology (CUBE) attempts to develop new initiatives—such as the present proposal—in collaboration with the relevant services and administrations of the member states. The range of this action embraces decrees, patent rights, publicity information and also collaboration with developing countries, etc.

—**Price Regulations for Raw Materials of Agricultural Origin:** New regulations for sugar (KOM(84)238, 25 April 1984, "Report by the Commission to the Council, Implementing Article 24 Paragraph 7 of Decree (EEC) No 1785/81 in the Sugar Sector") and starch (KOM(84)620 final, 27 November 1984, "Proposal for a Council Decree Setting the Basic Rules for Production Compensations in the Grain and Rice Sectors"—Council decision 25.3.86, ABL L94 6.4.86—decrees (EEC) No 1006 to 1010/86) were adopted in 1986 in order to promote the maintenance and supply of raw materials at prices which are valid outside of the Community. These regulations already have positive effects on investment in the industrial sector and they will have even more positive effects in the future.

—**Decrees:** It is important to harmonize the decrees on a Community-wide basis in order to create clear and supportive general conditions for promoting innovation in the biotechnological sector whereby high safety standards for humanity and the environment are simultaneously maintained. In December 1986, resolutions were drawn up (ABL 15/83, 17.1.87: Council Guideline 87/11/EEC for the coordination of measures by the individual states with respect to the marketing of technologically valuable medicinal products especially from biotechnology), in order to promote concerted action by the member states, promoting the introduction of new pharmaceutical and veterinary medicine products to the market and concurrent innovations in this sector. In November 1986 the commission expressed its intention (KOM(86)573, "A Community Framework for Regulations in the Field of Biotechnology", 4 November 1986) to prepare proposals for regulating the use of organisms in the industrial and agricultural sectors and in the environment. These preparations are already well advanced.

—**Regulations for Intellectual Property:** Special scientific-judicial problems arise in the field of biotechnology. With respect to certain elements, the conditions in Europe are less favorable than elsewhere. Proposals for establishing a Community law are in preparation in order to facilitate innovation and to promote harmonization of intellectual property protection in the field of biotechnology including the agricultural sector.

—**Demonstration Projects:** In their proposals of 1984 (KOM(84)230, "Proposal for a Council Resolution Regarding Adoption of a Multi-Year Research Action Program for the European Economic Community in the Field of Biotechnology (1985-1989)", 26 April 1984, accepted on 12.3.85) for an action program in the field of research, training and coordination, the commission noted that proposals for a demonstration project should be made at a later time, after the R&D projects of the EC have made further progress and the goals to be set can be better evaluated. The present proposal moves in this direction, the center of gravity being on developments in the entire field of R&D.

Although Community expenditures in the field of biotechnology, just as elsewhere, constitute only a small fraction of the total programs of the member states, they can make a significant contribution toward promoting the cohesion and effectiveness of these efforts. Community initiatives on the present proposal can deal with problems which are outside the scope of purely national programs. Through Community projects, the elements for solving a national problem could be found in the experience of other member states. Similarly, Community programs can create the basis for internationally acceptable standards.

1.4 Agricultural Policy, Position of Parliament on Biotechnology

The "great debate" concerning the demands on European agriculture was initiated in July 1985 through the Commission in Gruenbuch (KOM(85)333 "Perspectives for the Joint Agrarian Policy", July 1985). The final inferences were drawn in December of the same year under the title "A Future for Community Agriculture" (COM(85)750 December 1985).

The following priority aspects were noted by the Commission:

- To gradually decrease surplus production and to reduce the resultant burdens on the taxpayer;
- To produce with a view to the markets within and outside of the Community and also the consumers' wishes to diversify and to improve quality;
- To give more efficient and more systematic consideration to the income problems of small family firm;
- To support agriculture in regions where it is necessary for land use planning, to maintain social balance and environmental protection;
- To make farmers more conscious of the environment;
- To promote the development of industries which process agricultural products thereby involving agriculture in the decisive technical changes currently taking place.

In the European Parliament, two resolutions were accepted in February 1987. The first, concerning "Biotechnology in Europe" stresses particularly the need for an integrated policy ("Biotechnology in Europe and the Need for an Integrated Policy", reported by Mrs. P. Viehoff, 18 November 1986, Dok. A 2-134/86, resolution: ABL No C76/85, 23 March 1987). The second, concerning "Biotechnology in European Agriculture" (report on "The Effects of the Application of Biotechnology to European Agriculture", reporter: Mr. Friedrich Wilhelm Graefe zu Baringdorf, 26 November 1986, Dok. A 2-159/86) states, among others, that the Parliament:

- is of the opinion that, in the present framework of biotechnology, an agrarian policy must be promoted which aims at quality with higher added value instead of increases in yields and amounts produced.

—is of the opinion that it is the duty of the European Community to support and promote such biotechnological research which improves alternative production forms or finds new ones.

It is clear that these challenges, to which the proposed program responds, must be seen in a global relationship. As the world's largest importer of foodstuff and its second largest food exporter, the development of Community policies for agriculture and biotechnology must be seen in close relationship with world trade.

Therefore, the actions and responses of the European competitors, just as those of the individual member states, must be taken into consideration.

1.5 Responses by the United States, Japan

Reports of the "U.S. Congressional Office of Technology Assessment" relay the message of agricultural usage spurred by technology (U.S. Congressional Office of Technology Assessment: "Technology, Public Policy and the Changing Structure of Agriculture," March 1986; and "A Review of U.S. Competitiveness in Agricultural Trade", a Technical Memorandum, October 1986). The "U.S. National Research Council's Board on Agriculture" has put forward the absolute need ("Agricultural Biotechnology: Strategies for National Competitiveness", National Academy Press, Washington DC, June 1987), to strengthen the public support of biotechnology in agriculture in order to be able to be competitive on international markets.

In the U.S., following the already noted success of the still running USDA program, "New and Alternative Products" (for instance, with the development of Kenaf as a source of fiber for paper production, or Guayale as a domestic source for rubber) were introduced and "The Development and Production of More Marketable Products" which fall in the realm of traditional foodstuff and fiber production were favorably acted upon by the Senate. Financing is provided by 75 million dollars per year, for the next 20 years. This is in response to a report by a task force ("New Farm and Forest Products: Responses to Challenges and Opportunities Facing American Agriculture", Report by the New Farm and Forest Products Task Force, June 1987), which advocates the development and marketing of new agricultural and forest products in the next 25 years. At least 150 million acres of useful agricultural land should be employed in order to satisfy the market demand which represents a new net demand for agricultural and forest products. The task-force estimates that, by reaching this goal, 750,000 new jobs could be created, agricultural earnings will rise by about 30 million dollars per year and the gross national product will increase by 1,000 million dollars per year. These statements may be overestimates. Nevertheless, there is no doubt that developments in the direction of increasing support for biotechnology form the basis for increased competitiveness.

In Japan, the public financing obligations for R&D in the field of biotechnology are considerably smaller than in the U.S. or the EEC. "Nevertheless, already 50 years ago, it has been stated as an element of national policy that plants, as sources of raw material based on solar energy, should be converted through biochemical methods into basic materials for the synthetic chemicals industry". (From "Historical Background of Industrial Fermentation in Japan" by Kin'ichiro Sakuguchi, Kyoto Fermentation Symposium, 1972). To this pre-war development for the production of chemical raw materials by means of fermentation, very valuable knowledge involving the production of antibiotics and additives for animal nutrition (amino acids) was added by post-war developments.

1.5 Actions in Member States

During the past year, every member state has applied measures to strengthen biotechnology and interdisciplinary research. International judgements must acknowledge Europe's scientific capabilities. Eventual criticism is aimed more at the ability to convert basic research and technological know-how into practical application and to market the results.

In every member state of the Community, the need for research and development in the field of renewable basic materials, the need for testing plants for their suitability as industrial raw materials and the need to apply the new tools of biotechnology to the above mentioned problems is considered important.

The current program brings to the foreground the considerable need for a Community initiative which is not only interdisciplinary among the biotechnological programs of the member states and international among the current Community research programs, but also between agriculture and industry. It will promote cooperation and thereby the exchange of ideas and individuals beyond the three sector borders which separate basic research, industry and the economy in every state.

2. Consultation with Scientific, Agricultural, Industrial Branches

2.1 Response to Call for Expression of Interest

In April 1986, the Commission raised the idea of a possible multi-year Community program of activities to stimulate agroindustrial development (KOM(86)221, "Biotechnology in the Community: Stimulation of Agrarian Industrial Development", 15 April 1986) and a few months later published a "Call for Announcing Interests" (Supplement to the official publication of the European Communities No S 137/29).

A report (Stimulation of Activities at the Intersection Between Agriculture and Industry—Results of the Call for Announcing Interests", March 1987, CUBE—XII 233/87) on the results of this call has been prepared and distributed. The results are summarized in the following:

Responses were received from 856 firms, institutes and universities from all 12 member states of the Community. Estimated total costs are 625 million ECU. Many

replies combine high ranking science with a practical economic presentation. From industry 266 replies arrived and many of them expressed the willingness for financial participation. The total costs of these projects came to 326 million ECU. All participants underline the need and desire to work on a Community framework.

The classification of these responses into thematic groups represents the nucleus of the current program proposal:

- those providing animal fodder materials (119 responses);
- optimal methods with the help of biotechnology, which provide answers regarding the metabolism and nutrition of plants and animals and on pest control (91 responses);
- those providing raw materials through industry, their utilization and processing (70 replies);
- integrated systems for land use, especially as defined through whole plant harvesting and biorefineries (32 responses).

The technical content of this program, as foreseen on the basis of these proposals and on the basis of the results of other consultations and recommendations, is summarized later in part 3.

A fundamental aspect of the program is the protection of the public and the environment. On this theme, a number of useful responses were submitted. This area of problems represents a part of the risk evaluation within the current biotechnological action program and, as a result of the revision of this program, it will be continued and made more thorough. Where it appears to be applicable, the results of the risk-evaluation research will be applied in the agroindustrial program namely in the framework of joint meetings, advisory visits from researchers in the field of risk evaluation, or also through other means. All contractors of the biotechnological program of the Community must uphold the national and Community laws applicable to their project. More extensive changes in the regional environmental conditions, in the natural ecosystems and in land utilization, which arise from the development of biotechnology-supported agroindustry, must be evaluated and, in the selection of priorities, must be considered for R&D.

2.2 Consultation of Representative Organizations

Fifteen representative organizations from various agricultural and industrial circles were requested to give their opinion on the discussion paper of the Community. It is presented in Table I. Additionally there also were direct discussions with certain circles such as the CEFIC

[Chemical Industry] and COPA-COGECA [Agricultural Producers and Associations]. The written responses are included in the report already referred to.

Table I: Organizations Which Gave Their Opinion on the Discussion Paper of the Commission, Involved With Agrarian-Industrial Development (KOM(86)221):

- Association of Enzyme Producers of the EEC (AMFEP);
- International Association of National Industrial Unions for Agrochemical Products (GIFAP);
- European Association of Animal Breeding (EAAP);
- Board of the Professional Agricultural Organizations of EEC and General Board of the Rural Partnership System of EEC (COPA-COGECA);
- Association of Veterinary Professionals in the EEC (FVE);
- Association of the Breeders of Plant Varieties of the EEC (COMASSO);
- European Society of the Cell Material, Paper and Pulp Industry (CEPAC);
- European Association of Societies of the Pharmaceutical Industry (EFPIA);
- European Board of Societies of the Chemical Industry (CEFIC);
- European Association for Plant Proteins (EUVEPRO);
- Society of the Agricultural and Foodstuff Industries of the EEC (CIAA);
- European Association for Plant Proteins (EUVEPRO);
- Society of the Agricultural and Foodstuff Industries of the EEC (CIAA).

The responses received supported with varying priorities a Community initiative in the agro-industrial field corresponding to the framework proposed by the Commission.

The greatest interest was expressed through COPA-COGECA and through CEFIC. COPA-COGECA is of the opinion that primary attention be given to the value added in agriculture itself and that use in agriculture must be economically justified. Furthermore, they are of the opinion that the Commission should reinforce basic structures and applied research in the field of biotechnology at the European level. They would welcome new or increased possibilities for significant marketing of products and they are interested in the replacement of imports.

CEFIC supports the Commission's initiative. Nevertheless, the chemical industry of the Community is interested in purchasing agricultural staples at internationally competitive prices. Furthermore, they say that, in the fields of grain, sugar, vegetable oils and fat, there is a potential for basic agricultural materials obtained within the Community under conditions that are favorable to agriculture and industry. They wish that the proposed program be complementary to BEP and BAP, and they

express their view that "the first priority is the stimulation of the development of biotechnology, resting on a solid scientific and economic basis".

They turned out a number of interesting oil-fruits which, as they express it, presupposing a certain amount of R&D, could be produced economically in Europe. These should be used as sources of fatty acids, for the manufacture of existing and new products—the CEFIC response is accompanied by concrete proposals for castor oil, rape and mustard which are considered possible industrial products. By exploiting all new and known technologies, they believe that a limited but high-priced market can be developed for custom tailored plants and products with a high potential value yield.

They also see the possibility of promoting projects involving the use of carbohydrates in the chemical industry. Finally, the importance of orchestration and coordination between the activities in the new Commission programs and the considerable efforts of the member states is pointed out.

CIAA has also stressed the interest in biotechnology although its response understandably cautions from attributing too great a market significance to the non-foodstuff sector for the Community.

The response by EFPIA brings out that possibilities for the use of modern biotechnology are present not only in the plant sector of agriculture but also in connection with health and productivity in the animal sector.

2.3 Further Consultations

With IRDAC [Biotechnology Workgroup of the Advisory Industrial Research and Development Board] intensive discussions were conducted in the course of the preparation of the proposed program, on the basis of which they have endorsed the program proposal.

PART B: PROPOSED COMMUNITY PROGRAM

3. Program Overview

In biotechnology, the broad range of specialized knowledge and abilities in all branches of natural sciences and related technologies, and the rapid worldwide progress make it impossible for the individual member states to be at the top and internationally competitive in all respective fields. This program opens up the possibility to achieve this competitiveness by incorporating the complementary knowledge of the member states.

The use of Community projects to stimulate a new agroindustrial development and related activities—exchange of research results and assistance in training and mobility—in the member states is a means for complementing national programs and is best suited for a Community-wide initiative. The proposed program

very closely corresponds to the selection criteria in supplement 3 of the Council decision (ABL L302/87) with respect to the framework program (1987-1991).

The program now proposed will attempt, through further research and technological development, to bring to practical application some of the existing research results and technical capabilities. Additionally, it should concern itself with technical practicability and to a certain extent with possible economic viability, for example, the effect on costs when produced on a wider scale. The program will strive to elucidate the more pertinent factors, such as the reproducibility of laboratory results, on a larger scale under research field conditions and under different climates on different soils in agricultural practice. Of course, it is also necessary to carry out experiments pertaining to processing that is subsequent to the harvest.

Where the number of projects and locations of the activities are limited by the necessary combination of the available means, the support of single individuals from other parts of the Community through mobility stipends will enable them to participate in the group project. Through such means the knowledge of different disciplines can be brought together and the results and experiences distributed more efficiently in the entire Community.

Field experiments and developmental projects are normally very costly and are sometimes difficult to carry out. In order to derive the greatest possible advantages from these efforts, it is necessary to distribute the results systematically. This must take place not only through the available distribution mechanisms but additionally through those which make it possible to reach new potential consumers especially in the field of industry. The member states will derive advantages from standardized field experiments, for example for a certain species, carried out on European soil, and from procedures which are used at the Community level. The results will be distributed free of cost over Community and regional borders; nevertheless, provisions must be made for the appropriate security of intellectual property as it was already developed with other Community research programs with industrial participation.

It is possible that the results of a member state could also be meaningfully evaluated under the agroindustrial conditions in a different country. Further development and evaluation of results may require additional work and investments. It is the goal of the proposed Community program that the industrial or other partners, which contribute to the financing of the project, will be sufficiently encouraged by the results and take themselves the additional steps which would result in improvements. (The Commission services which are charged with the implementation of the action, named under 8.4 of the program framework, can, where necessary, stand by the contracting partners in order to successfully and economically apply their results.)

4. Program Structure, Content

At the center of gravity of the program will be the examination as to how the creation of value in this total area may be increased through the closer cooperation of agriculture and industry. Proposals which aim to link pre- or post-agricultural industrial activities with agriculture will be particularly encouraged. It is obvious that only those proposals can be considered which utilize the most recent scientific knowledge.

Another essential criterion in the selection of projects is the effect they will have on maintaining and promoting environmental protection. Based on views expressed by interested individuals and professional associations, the following areas appear appropriate for project support:

4.1 Agricultural Production for Industrial Utilization

This involves essentially the further development of existing and new development of alternative agricultural products. In particular, it has a number of different aspects such as the characterization, selection, use and distribution of new biotechnological methods. A broad field will be occupied by agricultural products corresponding to industrial needs, thus opening up additional markets. Preference will be given to projects which:

- take into consideration the requirements of industrial distribution;
- promise advantages for animal nutrition.

The corresponding projects will involve experiments of varying size, under the most varied pertinent conditions such as climate, soil, fertilization, feeding, etc.

In particular, in the plant sector, one can think of further developments in the cultivation of flax with respect to fiber strength and seed yield, of sunflowers with respect to a high fatty acid content, of rape with respect to a high erucic acid content, of soybeans with respect to climatic adaptation to Central European conditions, etc. For animal nutrition, significant experiments, such as those developing more nutritive fodder materials or pertaining to improved digestibility, will certainly play a major role. In the past, the first advances in this direction were made with lysine-rich barley, among others.

4.2 Industrial Aspects

In the area of industrial production, projects which precede or follow agriculture are involved. Technical development in the industrial sector has been stormy during the past decades, especially with respect to agricultural tools which, in addition to breeding measures, have decisively contributed to a permanent increase in yields. Advancement in the field of processing agricultural products originating in the Community has been less rapid, because the industry relied on cheap raw materials derived from the agriculture of third countries, on the one hand, and on the processing of crude oil, on the other hand.

In the area of operating tools, the future priority will be to promote projects which are involved less with the increase of yields, but instead will have a more favorable effect on environmental compatibility. In particular, one can think of continuing the efforts in the field of biodegradable plant protection chemicals having specific application spectra, with the help of biotechnology. At the same time, of concern will be new microbial procedures which promote plant nutrition, for instance, with respect to nitrogen, phosphorus and trace elements in vegetables, grains, trees and other woody plants. Projects which enable a better utilization of fertilizers and thereby limit losses by leaching, will be of particular importance to the environment.

With respect to post-agricultural industrial activities, there are, for instance, new procedures for isolation or processing by which traditional technological procedures may be adapted to the state of modern technology. Naturally, this also involves finding new uses for certain ingredients of particular products. In this context, one can think, for instance, of flax, rape, but also starch. This may concern, among others, new uses for erucic acid, obtained from rape oil, but also new packaging material made from starch under high pressure. The broad introduction of such a packaging material, which is biodegradable, could be considered a decisive breakthrough in the environmental field. The list of possible applications is particularly long in this field, because starch and sugar, significant components of agricultural products, can be processed into the most diverse industrially useful intermediate products.

4.3 Integrated Projects

These projects can address many topics which involve integrated agricultural industrial projects, such as the total plant harvest, on the one hand, and the use of modern technologies on the individual farm, on the other hand. Total plant harvest involves the assignment of some use to every part of the plant, instead of leaving behind a part of it on the field, which is the common practice today. A suitable plant, eventually a new breed, will be cultivated by means of a specific technique and brought in using a special harvesting technique. Its economic exploitation should take place at a central processing point supplied by several growers. In such a place, the plant can be divided into its individual parts such as stem, leaves and seed, and each separate part can be delivered for specific processing. These proposals are not new. Complete harvest and preparation are current methods in the making of hay and fermented fodder. Another example for such a procedure is the setting aside of straw in grain cultivation and its subsequent use in cellulose manufacture.

Integrated technology involves the application of modern communication equipment, automatization processes and the introduction of new, fully automated chains of mechanization. These techniques will lead to rationalization in the agricultural industry.

5. Program Management

The projects will be carried out in the form of contractual research projects and development, based on shared costs. The program also provides for training and mobility assistance according to part 5.3, as well as coordinating activities.

5.1 Preparation, Management, Evaluation of Programs

In their task of preparing developmental activities—within the framework of the conditions defined by the Council decision—and with regard to the management program, the Commission will be supported by an advisory Management and Coordinating Committee for agroindustrial development rooted in biotechnology. In order to ensure good coordination with the corresponding programs, it is desirable that this BVKA include representatives of other interested BVKAs especially of the BVKA for biotechnology and of SCAR [Permanent Board for Agrarian Research]. In the definition of leading topics, the BVKA will have an advisory function. The priorities will be presented unequivocally in the requests for proposals. Similarly, the BVKA will assume a key role in the increasing and efficient coordination between national activities and the present programs.

The program will be evaluated in agreement with the "Report to the Council on a Community Action Plan Concerning the Evaluation of Research and Development Activities Over the Period 1987-1991", KOM(86)669 final. A sum of about 150,000 'account units' is provided for this purpose.

5.2 Participants, Size of Projects

The participants in the research programs can be industrial and agricultural firms, associations, joint efforts of such undertakings, research institutes and universities of the Community. Normally, research institutes and universities should only participate in projects whose financial sources (other than from the Community) are essentially derived from industrial or agricultural firms or from a joint effort.

Special efforts will be expended to interest possible participants, especially the mid-sized firms, to submit proposals. Newly created contacts, in close collaboration with the BVKA, will be used for this purpose. In order to inform and entice the proposal makers to let their interests be known at an early stage, an information document, containing all of the necessary details of information, will be published, and first of all, an announcement will be published in the official register. The proposals should take into consideration participants from more than one member state.

Responses should be of sufficient scope to achieve significant and reliable results. It is likely that the average scope exceeds that of the average basic research.

It is to be expected that a typical project will involve a series of contracts addressing various aspects of a representative problem. For every project, proposed goals, duration, and plans will be set through the Commission with selected respondents to the announcement process. An average or a typical project will involve five contract partners, where each will be awarded a sum of between 0.2 and 0.5 million ECU per year, for four years, for personnel, equipment and operating expenses. Consequently, the total project costs will be of an order of magnitude between 2 to 8 million ECU, out of which no more than 50 percent will be absorbed by the Community.

Within the three sectors (see 4.1, 4.2, 4.3), there can be an average of ten such Community projects, and each of them will receive an average of 2.4 million ECU from the community. As an approximation, within the first sector, one or at most two target varieties, such as oil plants, grains, fiber plants, ligneous plants or animals, may be chosen.

A similar concentration will be applied in the other sectors. A project can provide for collaboration beyond given sectors, for example, work with a particular species, work involving the particular conditions for its cultivation, and/or the development of appropriate industrial processing technologies.

5.3 Training, Mobilization Stipends

Stipends are provided in the program, facilitating training and/or mobility, under conditions which affect particularly the goals and distribution of the program results. Two typical cases would be:

- An advanced study stipend enabling a young investigator to join a project group outside of his nation, thus utilizing the benefits of his experience and his labor, but primarily providing a learning experience which he would take home or elsewhere at the end of the project.
- A mobility stipend, which will be used to recruit for a project or to relocate an experienced scientist or engineer, whose experience will be used in another place within the collaboration.

The stipends can be established for the duration of the project or for a shorter period, depending on the need which is derived from the project and from the individual wishes of those involved. The invitation to the competition will be issued after the launching of the program.

The scientists will receive direct payments from the stipend. When needed, compensatory payments will be made to the hosting institution; nevertheless, the activity will be functionally included into the project.

5.4 Coordinating Activities

As stressed in part 5.3, an important part of the program will be the promotion of coordinated activities of the agroindustrial development in Europe. This includes coordination within the member states and also intersectoral coordination. This coordination will be realized in part through the implementation of the program, but also through the assistance and collaboration of BVKA, IRDAC, SCAR and all of those responsible for the national activities.

5.5 Access to Results, Their Evaluation, Dissemination of Information

The general rule for the use of results is provided in the Commission proposal which will be submitted to the Council as prescribed by articles 130K and 130L of the Uniform Acts.

These conditions were set up for other community programs of great industrial importance, especially BRITE. Details with respect to rights of access, licenses and other general information will be published in an information package, as for BRITE, which will be distributed during the preparatory phase of the projects.

6. Criteria for Project Selections, Relationship With Other Programs

6.1 Criteria To Be Applied in Project Selections

There exists a broad spectrum of possible activities in connection with this kind of a development program. In order to avoid the wasteful scattering of budgetary resources among innumerable, economically hardly supportive individual projects, it is necessary to limit oneself to certain types of activities selected with the strict application of suitable criteria. The following criteria will be used:

- The projects must be first of all targeted on the practical application of the results of basic or experimental research with the help of biotechnology, in order to develop systems, built on a secure scientific and technical foundation.
- In selecting the projects, the emphasis will be placed on the economic practicability of the proposed activity. To prove this, it will be expected that, as a rule, the business in its proposals will obligate itself to assume at least 50 percent of the project's costs during the contract period.
- The projects must be capable of contributing to economic strength and competitiveness, and to the particular advantage of the European Community.
- Priorities must be selected in such a manner that undesirable side effects on the environment would be avoided. More beneficial effects could be considered as contributing for a favorable evaluation.

—While considering the relatively high costs of development projects, proposals should be made in such a manner, that it should be possible to easily evaluate relative international merit, progress, achievements and end results.

—The selected projects must not lead to competitive distortions on the Community markets.

6.2 Relationship, Collaboration with Other Community Policies, Programs

Framework Program

This proposal for an agroindustrial technical program based on biotechnology is part of the Community framework program for research and technological development (1987-1992) under the heading "Exploitation and Optimal Use of Biological Resources". It will be coordinated with the other current and future actions entitled "Biotechnology" and "Competitiveness of the Community and Management of Agricultural Resources," and it will greatly supplement these. The main goal of the present program proposal is the development of projects, which will possibly lead to new or improved products, procedures and services which also, necessarily, demand industrial investment.

Under the title "Agroindustrial Technologies", a program proposal will be submitted which will likewise affect the technologies of the foodstuff industries, supplementing ECLAIR.

Forest, Biomass Programs

About 5 percent of the responses to the request for interest declarations pertain to projects in the field of forest management. Some of these could overlap with the current program involving the production and use of wood as raw material, and with those of biomass for energy purposes. This is also true for forest projects within the agricultural sector. Careful attention will be paid to avoid overlapping with these programs and to assure agreement with them. Every forest and biomass production program under the present program proposal should deal especially with the development, for special industrial purposes, of systems which take into consideration the research results. The selection criteria will favor projects which involve scientific and industrial collaboration, whereby the emphasis is on biotechnology. Taking into consideration these remarks, the forest or biomass production projects will be placed under the heading in Part 4.

Competitiveness in Community, Management of Agricultural Resources

The goals of current and future Community programs for the coordination of agricultural research are derived from the requirements of agricultural policy. Current programs and plans contain such elements as diversification, higher quality, lower production costs, forestry

considerations, and efficiency in the use of the human work force. Therefore, there are various identical interests with ECLAIR. These are being discussed in detail among the various offices of the Commission, and a tight coordination will be secured in order to guarantee the natural complementarity of the two activities, and to avoid any possible duplication.

Environmental Aspects

Special attention will be paid to the avoidance of eventual harmful, and to the promotion of favorable, environmental effects as a result of the proposed activities. Biotechnologies in general have a strongly positive influence on the environment insofar as they decrease agricultural waste and waste of energy as well as of manufactured products, on the one hand, and introduce simple, energy efficient procedures, on the other hand. This ability is in no way contrary to the central theme of the program, instead it fully supplements it. As already mentioned in the fourth action program of the Community for environmental protection (KOM(86)485 "Fourth EC-Action Program for Environmental Protection"; 1987-1992), in the development of technologies, products and services, there is a considerable economic chance to protect and improve the environment.

6.3 Coordination With National Activities, Collaboration With EUREKA

In the various member states there develop or are prepared public and private initiatives which are in agreement with some of the goals and methods provided in the proposed program. Participation in a Community framework could offer advantages with respect to access to a broad framework of knowledge and techniques. This is also true for the partner to be considered for Community financing and the distribution of costs and risks, the critical volume, which is necessary for the achievement of successful results, plus easier access to the market of the Community for the distribution of results and an eventual marketing.

Those responsible for the ongoing activities in the member states are called upon to establish contact with the Commission in order to coordinate efforts, to exchange information and develop forms of collaboration in agreement with the goals and conditions of the particular programs.

The projected, more general and competitive technological efforts in the proposed Community program should create possibilities for EUREKA projects with an economic goal.

7. Financial Aspects

7.1 Contracts, General Rules

As a rule, Community financing should, at the most, amount to 50 percent of the total costs of the project. The rest, in its overwhelming majority, should be financed by industry.

Total financing from the Community budget, for contracts including training and mobilization stipends, is estimated at 72 million ECU. Based on the consultations already completed and the survey of interests carried out, the potential exists for a considerably larger program (when considering the proposals and offers of co-financing). Nevertheless, with efficient investment planning and management according to the above explanations, the amount will be sufficient for offering a good foundation for a small number of decisive advancements in each of the three areas.

In consultation with the BVKA on the basis of responses to the request for the submission of propositions, the commission will make the final decisions which will be published.

7.2 Current Costs

A financial participation of the Community in the amount of 2.5 million ECU is foreseen for the various areas, the most important of which are listed as follows:

- Meetings and workshops for contractors for the exchange of results between teams and other interested experts, discussion of problems and advances;
- Support of coordination projects (meetings, experts, etc.)

7.3 Personnel Costs

Carrying out the program requires the spending of 5.6 million ECU for a staff of 13 employees: 7 employees of career group A;

- 1 employee of career group B;
- 5 employees of career group C.

The employees will be collaborating closely with the contractors to build up a broad contact network with the participating industrial groups and organizations. As a background for the already mentioned coordinating actions, with the support by members of the BVKA, they should familiarize themselves with the corresponding national efforts in state research stations, agricultural institutes and universities.

Taking these requirements into consideration, two science employees for each of the three sectors described in Part 4, with corresponding additional assistant personnel, must be considered a minimum necessity.

FACTORY AUTOMATION, ROBOTICS

Results of Esprit CIM, Other Factory Automation Projects

36980331a Paris INDUSTRIES ET TECHNIQUES in French 1 Jun 88 p 40

[Article by Mirel Scherer: "CIM [Computer-Integrated Manufacturing]: The First Effects of the Esprit Program [European Strategic Program for Research and Development in Information Technology]"; first paragraph is INDUSTRIES ET TECHNIQUES introduction]

[Text] Thirty-six Esprit projects involve CIM. Some are already successful, e.g. the CNMA [Communications Network for Manufacturing Applications] project used at BMW. From the Madrid symposium.

Pragmatism dominated the fourth Esprit CIM symposium held in May in Madrid. It thus became possible to assess the progress of this ambitious program which, in 1984, launched a multitude of CIM projects, most of which have already found industrial applications. In communications, for instance, the CNMA project is already implemented in pilot industrial facilities at British Aerospace, BMW and Aeritalia. At BMW in Regensburg (FRG), it takes the form of a local area network covering 30 km and with 600 connecting nodes. The network has been operational since January 1988; it includes a Targon (Nixdorf) minicomputer connected to an IEE-802.4 wideband token ring network, and two Sicomp (Siemens) computers, each connected to an individual IEE-802.3 baseband network. These two networks are interconnected by Bull or GEC [General Electric Company] routers. This network—the first implementation of the MMS (Manufacturing Message Specification) protocol in the world—collects and processes machine maintenance and servicing data in order to ensure production continuity. Some 200 programmable controllers are permanently on-line with the Sicomp computers which are themselves on-line with the Targon.

Targon Archives Data and Makes Decisions

The Targon computer archives data and makes decisions. The next CNMA system to be installed, at the Turin plant of Aeritalia, will be operational in October 1988. Designed for the manufacture of fighter aircraft, it will connect numerical-control punching machines, programmable controllers and Olivetti minicomputers. The technical database will be created and maintained by an SPS-7 (Bull) computer connected to the existing Vax 8250. All this hardware will be interconnected by an Ethernet-type network.

Another project under development: the CAD*1, designed to develop a standard interface for the various CAD systems used. Twelve partners from 6 countries are working on this project, which is part of the larger STEP project [Standard for the Exchange of Product Model Data] launched in 1985.

Closer to production, the Esprit project No 278 resulted in the development of a robot system guided by vision and touch sensors. Several manufacturers worked on this project, which was also launched in 1985: Bosch (for the robot), the Newcastle University (which developed the algorithms, the VLSI [very-large scale integration] circuits and the software required to adapt the Magiscan-II vision system), and Mari (together with the Newcastle University, it developed the touch sensor used). The gripping system of the robot and the addition of other sensors (force sensor, laser sensor, etc.) were completed on the pilot site set up at the Institute for Automated Production in Stuttgart. The system will also be provided with a communication protocol based on the EIA [Electronics Industries Association] RS-511; it will therefore be easier to integrate into complex automated facilities. Finally, the participants are eagerly awaiting the results of research on a possible way to connect CAD systems with sensors, now being carried out by a group of scientists at the New University of Lisbon (Portugal).

The Esprit project No 504, too, has several participants, one of which is the French company Adersa. The project goal, a major one as far as production automation is concerned, is the integration of fault-tolerant control, diagnostic and decision-making technologies. Research for this project used a flexible transmission-manufacturing cell set up at Ikerlan, Spain. The main components of the system are the CMH-50 (Soraluce) machining center, the Danumeric-2 (Danobat) CNC [computer numerical control] lathe, the IRB-60 (Asea [Swedish General Electric Corporation]) robot and the archiving HP-1000 computer. The key components of the system are the two data-acquisition and data-analysis systems which monitor the machining center, the robot and the CNC lathe. They are linked to an MRP-II-type computer-aided production management system. The system required a Fr30-million investment and will become operational in December 1988. Users, such as British Aerospace, Peugeot and Ford, are eagerly waiting for it.

The second stage of the program, Esprit II, just started; it will be expanded to include processing industries. Esprit-II CIM will have a budget of about 60 million ECU [European currency units] and will include a major project designed to integrate production automation technologies.

MICROELECTRONICS

Finnish Firm Develops 'Atomic Layer Epitaxy' Process in RACE Program

36980326 Bern *TECHNISCHE RUNDSCHAU* in German 29 Apr 88 pp 56-59

[Article by Ernst-Karl Aschmoneit: "Atomic Layer Epitaxy: The Basis for Flat Electroluminescent Screens"; first paragraph is *TECHNISCHE RUNDSCHAU* Introduction]

[Excerpts] Within the Framework of its RACE program, the European Community is also seeking to establish a joint communications network. The Finnish firm Lohja Finlux, located in Espoo (near Helsinki), has been chosen to supply the necessary color terminals with flat screens because of its extensive experience with electroluminescent displays (EL), which emit light under the influence of electric fields in solid bodies.

Lohja Display Electronics developed the process of atomic layer epitaxy (ALE) for the production of thin film electroluminescent (TF-EL) displays, and in early 1987 the firm introduced the first European television with a flat 7-inch diagonal screen. The screen needed for equipment in the RACE program [Research and Development in Advanced Communications Technologies in Europe] is to be double the size. In conjunction with Lohja, the project director, the University of Ghent in Belgium is developing thin layer transistors, while the French firm Matra is responsible for EL-terminals, and the Italian-French firm SGS-Thompson provides special circuits.

"Self-Controlling" Process

The distinguishing feature of the ALE process is the virtually errorless formation of extremely thin films on crystalline or amorphous substrates through a series of surface reactions, during which only one element of the desired bond is deposited each time. This self-controlling process accepts only one atomic layer per step. During semi-conductor manufacturing, layers of single elements grow epitaxially in many atomic layers strictly according to the structure of the substrate. In the ALE process, however, polar bonds, which are considerably stronger than bonds between like elements, are formed between elements that change with each layer. In order for the first atomic layer of ZnS film to achieve this polar bond, the substrate must have Oxygen (O) on the surface, like ordinary glass or thin oxide films.

After attempts to deposit the monatomic films by means of vacuum evaporation or a gas flow apparatus, the method of molecular beam epitaxy (MBE) proved particularly suited for the task. Ordinary reactors were prepared for the reaction elements with a sensitive temperature control system and reliably tight seals on the heating tanks. During the Zinc vacuum evaporation Zn atoms bond to the O atoms, creating a closed layer.

Once all the O atoms on the surface have been saturated, any excess Zn steam can be drawn off. Next, sulphur is vacuum evaporated in the same way and forms the second layer. Through renewed Zn vaporization and reiterations of these simple steps any number of alternating monatomic zinc and sulphur layers can be grown. Instead of the pure elements Zn and S, zinc chloride (ZnCl_2) and sulphur dioxide (H_2S) molecules can also be used as reactants. In the first step, the Zn component of the vacuum evaporated ZnCl_2 bonds to the O atoms of the substrate. As soon as the H_2S is added, the S atoms replace the chlorine. Then the first step can be repeated and layer after layer deposited. ZnCl_2 and H_2S have certain advantages as starting materials. On the one hand, the chances of the bonded zinc re-evaporating is reduced because of the chlorine component insulating the layer. On the other hand, molecules that contain a single S atom, like H_2S , are more reactive than double or polyatomic groupings.

Contrary to conventional thin film techniques, growth in the ALE process is not dependent on the reaction rate, provided that at each stage of the process enough of the pertinent element to form a full monatomic layer is vacuum evaporated. In addition, even a larger surface has completely uniform growth. Another positive trait is the fact that the thickness of the layer that develops no longer has to be measured because it is determined by the number of completed reaction steps alone. The process results in highly stable and stoichiometric films because all atoms, which have only a loose chemical bond to the surface, evaporate automatically as a result of the relatively high substrate temperatures in each reaction step.

To guarantee the formation of errorless monatomic films in a reasonable amount of time, a sufficiently high partial pressure of at least 10 μbar with a temperature of 450°C for ZnCl_2 and Zn must be maintained in the reaction chamber during vacuum evaporation. On the other hand, the partial pressure must remain below the steam pressure of the reactants for every process temperature that arises, for even the smallest condensations disturb the growth process. While the steam pressure at 450°C in the case of H_2S and S is very high, it still amounts to only 3 mbar with ZnCl_2 and only 0.5 mbar with Zn. Thus, permissible partial pressure ranges are 0.0001...0.3 mbar and 0.0001...0.05 mbar for ZnCl_2 and Zn respectively.

Multilayer Construction

The light-emitting film must pass muster not only for its optical characteristics, particularly its luminance, but also for its chemical and electrical stability. This is why it must be isolated on both sides with dielectric seals. In order to prevent sodium from defusing out of the glass substrate into the films, the substrate is coated with an ion barrier. For this, amorphous Al_2O_3 proved to be effective. A 50 nm layer of Al_2O_3 prevents stimulation by the high sodium concentration in the glass, even during the heat-up periods. Although the puncture strength of Al_2O_3 is very high, it becomes even higher when mixed with TiO_2 . The transparent front electrode conductor strips, which consist of sputtered indium tin oxide ($\text{In}_2\text{O}_3\text{-SnO}_2$ or ITO), lie on this insulating layer of $\text{Al}_2\text{O}_3/\text{TiO}_2$. They have a resistance of $160\ \mu\Omega \times \text{cm}$ and more than 80 percent transmission ratio. The surface resistance for large matrix displays was not to exceed 20 Ω .

In the growth of layers, the light-emitting ZnS:Mn -film, flanked by two dielectric $\text{Al}_2\text{O}_3/\text{TiO}_2$ layers, is also followed by the rear electrode and an additional Al_2O_3 -passivation layer. Depending on the envisioned application, the rear electrode can be made out of sputtered ITO or metal. In the case of ITO, the entire thin-film structure, which is extraordinarily thin at 2 μm , is optically transparent. Because high-resolution matrix displays place fairly large demands on the conductivity of the rear electrode, it would be most functional if made out of a metal like aluminum as long as transparency is not a factor. One of the tasks of the passivation layer, which is printed black to increase the contrast, is to insulate the entire structure, particularly the active film, from mobile ions. It is advisable to place a glass plate on the back for support and to coat the front—especially during use in bright light—with an anti-reflex foil.

Precision photolithographic techniques can be used to shape the electrode strips and the pixels, i.e., the tiny light-emitting areas at the junctions of the strips. This makes it possible to achieve pixels with etched contours, even for large display surfaces, thus ensuring a high resolution when displaying characters and graphics. Figure 4 (not reproduced) shows that the ZnS:Mn -film emits a broad spectral band ranging from green to orange, including a pronounced yellow light, with a maximum of 580 nm wavelengths. Pixels triggered by individual stimulation with alternating voltage through an X/Y matrix light up with each change in the electrical field. Thus, the more frequent the voltage changes, the greater the number of light impulses. There is a linear relationship between frequency and luminance.

Flat Screens and Large-Surface Luminous Displays

The structural design of a complete display unit is shown in Figure 6.

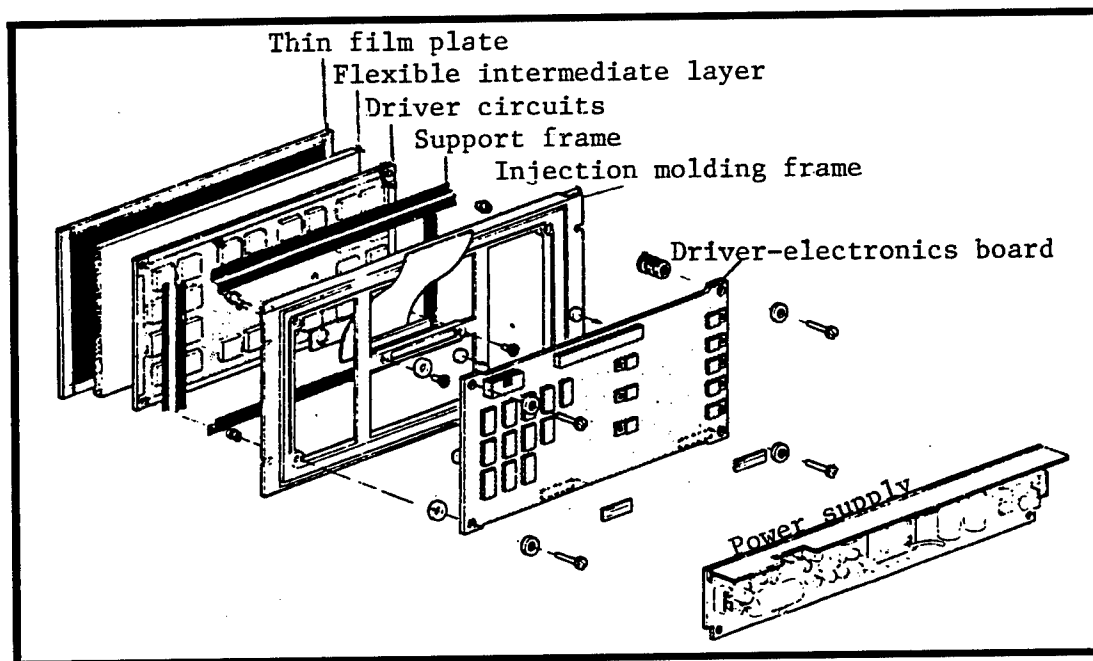


Figure 6. Mechanical Construction of a Display Unit

Aside from the framed thin film structure, the unit contains two printed boards full of integrated circuits. This involves high-voltage driver circuits, pulse wave generators, and master oscillators, as well as the synchro generator and the microprocessor, which is equipped with a character generator and a picture frequency control system. Finally, the power supply is attached to the current source. With the input of displayable information, writing pulses from the driver-electronics board successively reach the horizontal and modulation synch pulses at the same time as they reach all the columns. A reset impulse terminates the input and allows the information to appear.

Development Plans

According to the plans of the aforementioned RACE project, terminals with flat color screens are on the way. This requires extensive research into the various chemicals that can be used in bonds suitable for the ALE process and that demonstrate electroluminescence in appropriate spectral regions. In addition, a screen design with good color rendering must be developed. Because the ALE process results in strictly two-dimensional layer structures, it is a natural move to stack three thin film surfaces that are illuminated with different colors and are sufficiently transparent, thereby arranging the points

on three planes one behind the other. On the other hand, one could also fall back on the triple principle proven reliable in color television picture tubes, whereby each color dot lies on a plane on the tip of a triangle. Only time will tell which solution is more practical.

13233

CNET of France Sets Up 5-Year Optoelectronics R&D Plan

36980328b Paris *ELECTRONIQUE ACTUALITES* in French 20 May 88 pp 1, 13

[Article by D. Girault: "A 5-Year Plan for 10-Gbit/s Optoelectronic Components"]

[Text] The Bagneux laboratory of the CNET [National Center for Telecommunications Studies], headed by Mr J.P. Noblanc, has set itself an ambitious goal. No more no less than to develop the integrated modules required for 10-Gbit/s transmissions within the next 5 years, and to use indium phosphide. Lasers, controls and signal-processing circuits will be integrated in the transmitting parts, and detectors and electronic signal-processing components in the receiving parts. This goal is part of a plan that will be submitted to the CNET directors in the next few days.

Under the plan, high-throughput components will be developed first; then, in a second stage, components including functions made possible by the expertise of optoelectronic integration acquired by then. One-MHz FSK [frequency shift keying] integrated single-frequency lasers and integrated or semi-integrated coherent receivers are therefore expected to be developed by 1993. According to Mr Noblanc himself, this part of the program will be more difficult to complete: coherent links are not well defined yet.

However, participation in the RACE [Research and Development in Advanced Communications Technologies for Europe] project on coherent system components headed by STL, an STC laboratory, must have helped the CNET define its objectives in this field.

To achieve these goals, the CNET will rely on the knowhow possessed by its three divisions: physics, optoelectronics and microelectronics.

Identifying Molecules Suitable for Thin Films

CNET physicists are investigating the optical and electronic properties of materials, identifying those that could be used to make components. A research program was thus initiated in collaboration with Rhone-Poulenc; its goal is to identify molecules that will readily form thin films. The division is also researching the possibility of using organic materials in non-linear optic applications. The problems encountered have to do with the fabrication of these organic crystals. The research will yield results in the long term; however, crystals of MAP [meta-aminophenol], NPP [n-pentylpalmitamide] and POM [polyoxymethylene] have already been proposed; a frequency doubler was made from non-symmetrical organic molecules in crystal form. Actually, the research also covers the development of monocrystals that would retain the initial asymmetry of the organic molecule. Note that the Quartz and Silica company bought the POM license at the end of 1987.

However, the bulk of the studies and research carried out at the Bagneux laboratory is based on 3/5 components. In particular, research is carried out on the development of heterojunctions requiring molecular-beam epitaxy and liquid-phase epitaxy equipment, as well as microstructures.

Since the future belongs to integration, the CNET goes "beyond microstructures" and investigates nanostructures jointly with the L2M, a CNRS [National Center for Scientific Research] laboratory located on the Bagneux site and employing about 30 people. This research is designed to develop a "quantum box" laser, i.e. a laser whose three dimensions would be quantum-sized which, according to Mr Noblanc, would offer "interesting" characteristics (low operating current, etc.). These developments are made possible by the availability of lithography machines working on 20 to 30-nm lengths.

Planned Integration of Electro-Optic Modulator and Laser

The optoelectronic division is working on the development of 1.3-micron and 1.5-micron lasers; the latter have the advantage of operating at a wavelength where attenuation is low although dispersion is greater than with 1.3-micron lasers.

The latter have been the subject of an industrial transfer to Alcatel. Actually, the structure proposed by the CNET is a BRS, a buried-ribbon structure, requiring a faultless junction of epitaxial sites, something which the CNET can do. Indeed, using organometallic compounds, the Bagneux laboratory can work on large plates and achieve excellent homogeneity of thickness and wavelength (a few percents); in addition, long-term production yields could be as high as 50 percent. Its OMCVD (Organometallic Chemical Vapor Deposition) expertise has also resulted in the licensing of OMCVD reactors to FRL, a French company, so that, if need be, the CNET can supply not just the OMCVD process itself, but the machines as well. The process was taken from a study by Thomson and further improved.

As far as 1.5-micron lasers are concerned, the laboratory aims to develop "highly monochromatic" structures for which it uses a function separation technique called "multi-section" (including one pilot section and one slave section) leading to the development of components with a line width of a few megahertz, and especially lasers that can be tuned over a bandwidth of a few nanometers. They are used for coherent transmissions and make it possible to reduce noise through detection with a local oscillator; the gain amounts to a few decibels.

In addition, the Bagneux CNET has initiated an InP electro-optic modulator and laser osmosis program. The first successful tests, however, used GaAs, because it is easier to work. Note that transfers of GaAs components to manufacturers will soon be completed. Actually, Bagneux can boast of its expertise in GaAs and InP ionic machining. What the laboratory wants, of course, is to go over entirely to InP, working in the 1.3 to 1.5-micron range. Thus, preliminary tests of a "curved" laser, using GaAs, with a waveguide outlet, should lead to an InP development.

Laser and Control Circuit Integration

The Microelectronics Division is working on the integration of the laser structure and control electronics on a single chip. Its goal, Mr Noblanc made it plain, is to use InP for everything, although preliminary work uses GaAs for the command/control section, so that the assembly will require two chips. Actually, two schools are working simultaneously, one on GaAs FETs [field-effect transistors] and the other on bipolar transistors (the laboratory has reached the validation stage of the first bipolar circuits) for the command section.

As far as reception is concerned, things look more simple, since components including a photodiode, transistor and polarization resistor on a single chip have been developed: photodetectors (-30 dBm at 560 Mbits/s, performance characteristics almost equal to those of hybrid detectors) were introduced in 1987. Researchers are now working on improving the transconductance of the integrated transistor.

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SCIENCE & TECHNOLOGY POLICY

Riesenhuber on EC, FRG Research Goals, Problems

36980332a Munich *INDUSTRIEMAGAZIN* in German Jun 1988 pp 50-54

[Interview with Federal Minister for Research and Technology Heinz Riesenhuber, by *INDUSTRIEMAGAZIN* staff]

[Text] Research funding. New EC technology programs have been signed and sealed, but many deficiencies in coordination remain—between poor and rich Europeans, in technical standards, and in the tempo of training for engineers. Research minister Heinz Riesenhuber takes stock of his EC presidency.

INDUSTRIEMAGAZIN: Mr Minister, what had you intended to do for the European Community, and what have you achieved?

Heinz Riesenhuber: We have made more progress than could have been imagined. A very experienced EC official said that never before has he seen such a large agenda for the council of research ministries. We have had to give content, by means of individual programs, to the framework program defined under great difficulties in 1987.

The largest such program was Esprit II [European Strategic Program for Research and Development in the Field of Information Technology], which concerns cooperation within the information-technology industry and which will have received 1.6 billion of the total fund of 5.4 billion ECUs by 1991 (one ECU [European Currency Unit] is worth a full 2 marks). In the first round we adopted the program Science for the promotion of cooperation and exchanges in European research. A funds increase of DM 120 million was agreed to for the program BRITE [Basic Research in Industrial Technologies for Europe], which concerns the promotion of pre-competitive industrial technologies.

Then we increased the biology program by DM 40 million and adopted the programs DRIVE [Information Technology for Safety in Road Traffic] and meteorology and chemical analyses. And all this was done in the first round.

INDUSTRIEMAGAZIN: Then nothing was actually destined to drop out of the running, which would surely be an unusual situation in the EC?

Heinz Riesenhuber: The second major sector, the joint research center, has yet to be given a structure appropriately designed for the future. In this area I hope we can come to a decision by the end of June.

INDUSTRIEMAGAZIN: The dispute about this research institution for the EC, which is to have its operations mainly in Ispra but also in Karlsruhe, has in fact a troubling history. Had you not laid this problem on the table back in 1983, in the previous German presidency, without in the end making any headway?

Heinz Riesenhuber: Yes, but I hope that now we can make the cornerstone decision. We want to direct Ispra toward important new sectors, to norms and standards, for example in environmental protection and safety as well as in the purity of foods. The unified norms and standards should enter into markets at the earliest possible time. Moreover we are striving for a much tighter management and more personnel changes. Ispra ought to turn to the markets and work together with businesses.

INDUSTRIEMAGAZIN: Then norms are to be the great move of European research and technology policy?

Heinz Riesenhuber: Do not underestimate the importance of norms and standards as a prerequisite for a joint infrastructure. I have introduced a memorandum on the question of the so-called tentative norm. I would like to see consideration being given as early as in the selection of projects as to how far they contribute to joint norm developments, so that even relatively small and medium-sized businesses can thus always find entry into the markets at an early date.

INDUSTRIEMAGAZIN: Surely these are infrastructure aspects that no longer have anything to do directly with the catch-up philosophy followed by the research policy of previous years, particularly at the West European level.

Heinz Riesenhuber: That is true enough. But here we still have a problem, inasmuch as the national economies within the Community are very differently developed. When Portugal spends roughly 0.13 percent of its gross national product for research whereas we Germans are spending almost 3 percent, you can see the striking variability, and also a need to catch up still in some parts of the Community.

INDUSTRIEMAGAZIN: But surely given today's rapid product cycles there is simply no spare time at all to overcome a development gap. Surely it is not a question here of who perhaps still manages to catch up, but who the first is, with new chips for example. Only the first one on the market makes a reasonable profit.

Heinz Riesenhuber: And so it is a crucial necessity just for us Europeans that we have joint norms. Whoever can rely in time on joint norms creates for his industry the prerequisite for the low costs arising from economies of scale due to mass production, can impress norms on the world markets and can considerably improve opportunities for his own industry.

INDUSTRIEMAGAZIN: In this area the Europeans have often enough not cut a very good figure in the past, such as in electronics and especially in entertainment electronics. So how do you want to change this?

Heinz Riesenhuber: Think of the Eureka [Initiative for Increased Technological Cooperation in Europe] projects, above all the high definition television project HDTV, for example. Here we want to promote a television standard in such a way that our industry can hold its own on the markets at an early date. In connection also with safety on the roads, with guidance systems as far as proximity warning systems, we must set the standards in such a way that our industry gains a lead. On the EC level this applies to the program Drive. Closely connected with this is the Eureka industrial project Prometheus, in which automobile and electronics firms are cooperating.

INDUSTRIEMAGAZIN: But this means also that once the state has created this optimal infrastructure it will withdraw from direct research funding for industry.

Heinz Riesenhuber: We in the FRG have been doing that for years now. In the EC the situation is somewhat different. But in Germany industry spent about DM 27 billion for research in 1983. Of that, the research minister paid about DM 2.3 billion. Today we are looking at industrial research expenditures of about DM 35 billion, of which the research ministry is contributing DM 2 billion. Thus there has been a distinct decrease in relative terms.

INDUSTRIEMAGAZIN: Are not you and your ministry gradually making yourself superfluous in this way?

Heinz Riesenhuber: Well, I like being research minister, and there is still a lot to be done. On the one hand, in basic research we are now setting to work arranging the partners for industry in such a way that new knowledge will be emerging rapidly. On the other hand we want to deepen cooperation between science and the economic sector in such a way that this new knowledge can be rapidly put to practical use. This purpose is served, for example, by our Center for Artificial Intelligence in Kaiserslautern, where from the outset the economic sector has played a decisive part. Universities and industry are working together in various other sectors, such as at the genetic technology centers in Heidelberg, Munich, Berlin, and Cologne, and at the Max Planck Institute.

INDUSTRIEMAGAZIN: But surely the EC is still engaged in plenty of so-called pre-competitive—in plain words: market-oriented—funding of technologies.

Heinz Riesenhuber: This is connected with the fact that the EC must also give opportunities to develop more to countries that have a very limited research infrastructure of their own. And often this is more easily done through market-oriented research. However total weight of these programs is not a crucial factor: 5.4 billion ECU in 5 years is not even DM 2.5 billion per year. And of this the amount chargeable to Germany's account, proportionately calculated, is about DM 600 million—that is, 8 percent relative to the budget of my ministry.

INDUSTRIEMAGAZIN: Let us stay with Bonn. Is not its research and technology policy much too fragmented? After all, your ministerial colleagues for defense, environmental protection, economics, and health, just to mention only a few, are also financing research and technology.

Heinz Riesenhuber: Here we have a far-reaching coordination of efforts that works. Bonn's total 1988 budget for research and development will probably be around DM 13.7 billion. Of this, the defense minister is likely to spend close to DM 2.8 billion. And the research minister is responsible for DM 7.6 billion out of the remaining DM 11 billion.

INDUSTRIEMAGAZIN: Does this include the postal service?

Heinz Riesenhuber: Inclusive of the postal sector, but this amount is small. But in fact there is a structural problem here. I hope very much that in the wake of its restructuring the postal service will also commit itself increasingly to research, because here there definitely are sectors very closely connected with postal and telecommunications matters, such as technology-based communication or the development of communications satellites. In Japan or the United States these fields are taken up by the postal and telecommunications administrations—regardless of whether they are still government-run or are already privatized.

INDUSTRIEMAGAZIN: In fact, in 1985 the idea was once discussed on uniting the research ministry with the postal ministry in order to be able to employ concentrated technology funding considerably more effectively in terms of its economic impact. Why did nothing really come of this idea?

Heinz Riesenhuber: For one thing there was and is an actually superordinate goal: The reorganization of the postal service as such. This has priority, along the lines of the proposals that have now been made by Mr Schwarz-Schilling.

For another thing I have been very pleased in recent years that here we have been able to enter into a very careful and timely discussion with the postal service on important strategic questions. What the postal service is now building in the way of infrastructures, including broad-band cable laying, is already so dovetailed that we

are taking great pains to win the support of industry in time for corresponding standards in the new technologies that are acceptable to the market. This applies even to such tricky points as the standard for digital mobile radio.

INDUSTRIEMAGAZIN: But how are things getting on with the civilian utilization of military research results? After all, in this area technical developments are proceeding so rapidly that often after only a couple of years one can no longer talk about military secrets that need to be protected.

Heinz Riesenhuber: Well, civilian utilization is possible with us, but it does not play any great role. In the first place this is due to the fact that only a little more than 4 percent of the total research budget of the FRG goes to defense. The figure is dramatically higher in Great Britain, France, or the United States. For example, in 1986—which is the latest year for which I have figures on this—the Americans spent the equivalent of about DM 20 billion of federal funds on microelectronics and information technology, predominantly from the defense budget.

Secondly, in German defense research a considerable portion of the funds goes into very specialized developments such as the further improvement of tank tracks. In such areas there are only very limited spin-offs.

INDUSTRIEMAGAZIN: Back to the European dimension. By international standards does the FRG really have enough and above all the right engineers for the future?

Heinz Riesenhuber: In many respects here some things have evolved extremely well within the last 10 years. The number of engineers has increased, their share in the graduating classes has increased, and by the way also the number of women among the engineers has increased. If I remember right, in 1987 this was 8 percent.

INDUSTRIEMAGAZIN: Recently the quota of women has frequently been treated somewhat as an end in itself.

Heinz Riesenhuber: I must say that at the moment there really cannot yet be any clear distinction from an end in itself here. But consider the labor market situation in the second half of the 1990's, when we will have smaller annual contingents of school graduates and at the same time a sharp increase in the annual groups of persons entering retirement. Then it will be very important to tap all our resources and not, for example, exclude half of the population.

Of course, in Germany this applies also at the regional level. There must not be districts that prosper and others in which neither training opportunities nor job opportunities exist for engineers. Germany is too small to be able to afford to dispense with resources.

INDUSTRIEMAGAZIN: But are the German engineers also business-minded enough? This question arises especially upon comparison with American engineers, who try much more to manage their own businesses—even within large concerns—and to make their profits. Is not this drive too much lacking among Germans?

Heinz Riesenhuber: In fact, contrary to expectations we have held our own very well on the world markets so far.

But I see a quite different serious problem. It must be asked after all whether in the 1990's we can still afford to take 13 school years to convey to young people what is done within 12 years in other European countries with which we must harmoniously keep step. Surely it cannot be right that our natural scientists come into responsible jobs at ages of 29 or 30 years, whereas others are already in the marketplace when they are 25 or 26 years old.

Here we still have a big problem facing us. The older the engineers are when they begin practice the less are they prepared to learn new things later, and also the less are they prepared to take any risks, possibly with a firm of their own. It is here that I see also a German deficiency compared to the Americans.

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Italian Participation In ESPRIT 2 Program Reviewed

*3698m420a Turin MEDIA DUEMILA in Italian
No 5, May 88 pp 50-53*

[Article by Giampiero Gramaglia]

[Text] The second phase of the EEC data processing technology program has been launched like a rocket with a budget of 5 trillion lira that will spur the work of 5,500 researchers. Three sectors are of primary interest: microelectronics, information handling systems, and integration of data processing into application systems. The Italian participation, initially low-profile, has strengthened under the stimulus of big companies such as Fiat and Olivetti.

The documents of the "Year 2000 Office" are "Made in ESPRIT." The new international norms on the format of documents were studied and prepared in culmination of a draft program of the European Community and subsequently accepted by the European association of electronic computer manufacturers and adopted by ISO, the International Organization for Standardization.

And the "Year 2000 Office" will certainly be equipped with the "minisupercomputer" that will be produced on the basis of the T 800 floating-point transputer, the most powerful microprocessor available on the market at this time. The latter emerged from the laboratories of another project of the ESPRIT program, "Supernode,"

which is progressing and aiming at development of a very-high-speed computer based on the T 800 that should provide a higher "price-performance" ratio than achieved thus far.

Thorn EMI and Telmat, two of the "Supernode" partners along with Royal Signals and Radar Establishment, the Universities of Southampton and Grenoble and Inmos and Aptor, recently announced production of two series of parallel-architecture computers based on the results of research conducted in the European context; and the two series, one produced in France and the other in the United Kingdom, will be compatible for the user.

ESPRIT, a title with multiple benefit, that refers to the European Community's strategic program for research and development in information technologies, that is, the EEC program in data processing technology, is progressing at breathtaking pace. The funds for the first phase have been spent, and effectively, more rapidly than predicted, and have served to launch more than 220 projects, on which about 3,000 researchers and engineers from more than 400 different institutions of all the "12" are working. And the second phase has already been launched, promptly, with the target of providing work for about 5,500 researchers. The first indications even offer hope that this goal may be surpassed.

Compared to most of the Community programs, which have to measure out allocations with a balance-scale, the financial resources that ESPRIT mobilizes are considerable. At the height of the commitment, the initiative will represent about 30 percent of the effort of the "12" in research and development of precompetitive data processing technology. Initially "tailored" for 3 billion ECU, almost 5 trillion of today's lira, half to come from the EEC budget and half from the involved companies and organizations, the program grew as it went along, and is currently "worth" 4.7 billion ECU in investments, about 7.25 trillion lira, during the decade 1984 to 1993. The first phase was to receive 1.5 billion ECU; the second was to be the same, but instead was given a figure more than double, 3.2 billion ECU.

Born of the desire for cooperation of the European "big powers" in data processing technology—12 companies including the Italian Olivetti and STET, ESPRIT became a reality and grew in record time, combining to its advantage the intuition of industrialists such as Carlo De Benedetti with the diplomatic ability of Etienne Davignon, then in charge of research in the Community (having been pitted against each other in the affairs of the Societe Generale de Belgique, De Benedetti and Davignon are establishing mutual respect based on the roots of that cooperation). The program passed through a pilot phase of immediate success, and launched into full activity beginning in 1984.

The operational procedure is as follows:

The European Commission publishes annually a call for bids, and the interested companies present their proposals for projects and research. Each project must include two or more industries, research institutions, or universities from different countries of the Community; and the promoters must be prepared to finance 50 percent of it, relying for the remainder on EEC funds.

For ESPRIT 2, the new phase of the Community program, the basic procedure remains the same, however—as explained by a Commission official—"some adaptation has been added," in particular in the main sectors of data processing technology attention, which have been reduced, as we will see, from five to three.

ESPRIT 2, which was added to the European Community's 5-year research program—along with other initiatives including "Brite," aimed at promoting innovation in the traditional activities—and was launched in 1987, received the final go-ahead of the council of ministers for research of the "12" on 11 April in Luxemburg. Italy was represented by Minister Antonio Ruberti. Karl-Heinz Narjes, vice president of the European Commission and in charge of research, commented on the decision in enthusiastic terms: "ESPRIT is the torch of European research: it is the most important research program ever launched in the Community."

The second phase seeks to establish a period of consolidation and confirmation of the results obtained by ESPRIT 1: in practice, basic objectives and rules are not quickly modified, and adaptation of the research sectors destined to benefit from the EEC funds takes into account the rapid rate of technological evolution," explained Carlos Llebaña, research spokesman for the Brussels Commission. Three directions have been given priority: microelectronics; information processing systems; and integration of data processing technology in application systems. A particular, and new, priority is assigned to computer-integrated production and to integrated circuits for specific applications.

ESPRIT 2, along with another Community initiative for basic and applied research, will also serve to investigate possibilities of applying the advantages of superconductivity also at not extremely low temperatures (and financing requests for projects of this kind can still be submitted up until 13 June). The goal of the initiative on superconductors is to bring together the specialists in up-to-date semiconductor technology and the new materials with the most prominent chemistry and physics experts of the same sector, to enable development of materials and equipment usable by industry. The phenomenon of superconductivity, that is, the virtual absence of electrical resistance at temperatures close to absolute zero, is beginning to be possible also at less extreme temperatures with the use of appropriate materials, and this could bring about significant developments in the field of data processing technology and microelectronics. Then there is the flavor of novelty in ESPRIT 2, on the front of international opening up and

transnationality of projects, with the possibility of participation being offered to companies and organizations of countries outside the EEC, in particular those of the European Free Trade Association, EFTA, of which Switzerland, Austria, Finland, Sweden, Norway and Iceland are members. A final element of novelty to underline: the effort to orient the program more toward industry, that is, toward industrial use and commercial development of the results.

With a "blighted" beginning, the Commission had already issued on 29 December last year, without waiting for decision by the council of ministers but based on the general agreement of the "12" to launch ESPRIT 2 quickly, a call for bids that closed on 12 April, the day after the final approval. And the first figures on the contract just completed show that the success of the EEC program on data processing technology has certainly not run its course, and that the interest of industrialists and researchers remains great and growing. Selection of the projects will require several weeks and will be concluded between the end of May and the beginning of June; and the first projects of ESPRIT 2 will get underway during the summer, according to estimates that may err on the side of optimism. From the outcome of the review one may also get some indication of the Italian participation, which, while it started in low key, then strengthened from year to year under the impetus, among others, of big companies like Fiat and Olivetti.

The figures on volume of requests are impressive: 700 proposals have been received with "great satisfaction" by Vice President Narjes, who is celebrating, for the last time, perhaps, the splendors of European research (his confirmation in the Community executive at the end of the year is not certain). Of the 3.2 billion ECU allocated to this phase, 1.2 billion will be used for the first contract: since the sum for the requests submitted thus far, that is, an overall total of 700, will be around 10 billion ECU, an extremely rigorous selection will be necessary, aiming, for example, at combining similar projects to avoid duplication and promote synergy.

The experts of the general management for data processing technology and innovation of the European Commission are sharing out by sector the 700 proposals for the review phase: 17 percent relate to microelectronics, 33 percent information processing systems, and 50 percent technology of data processing applications (and of these 25 percent on computer-integrated production, 14 percent integrated information systems, and 11 percent data processing application support systems).

It is emphasized in Brussels that many of the proposals come from neophytes, that is, from organizations that have not participated in ESPRIT; and it is added that other proposals come from departments or laboratories other than organizations already involved in the program. To guide itself in selection and the decisions, the Commission convened for the first time, in mid-April in

Brussels, a new ESPRIT consultative committee, composed of important individuals in European data processing, both industrial and academic.

[Box, p 52]

The first phase of the ESPRIT program launched 219 projects, now at various stages of advancement, in the five selected sectors of activity; 32 projects have an Italian leader. We give you this list, sector by sector, as follows:

Microelectronics—45 projects, in five of which the leader is Italian:

- Telettra SpA of Vimercate (Milan) for "CAD methods for analog gas monolithic IC's";
- CSELT SpA of Turin for "Integrated opto-electronics on INP";
- IESS-CNR of Rome for "0.5 micron X-ray lithography: sources, masks, resists and transferred images";
- CSELT of Turin for "Automatic design validation of integrated circuits using E-beam";
- SGS-ATES of Agrate (Milan) for "Substrates for CMOS VLSI technology."

Software Technology—46 projects, in five of which the leader is Italian:

- Delphi SpA of Viareggio for "Chameleon-Dynamic software migration between cooperating environments";
- Olivetti SpA of Pisa for "Software development demonstrator through graspin [as published] methods and tools";
- Olivetti SpA of Pisa for "Advanced interactive application oriented technologies for software development";
- Fuigi Italiana SRI for "Software productivity evaluation model, SPEM";
- Txt-Techint Soft and Telem—for "Distribution and reusability of ADA real-time applications through graceful and on-line operations."

Advanced Information Processing—52 projects, in 12 of which the leader is Italian:

- CISE of Segrate (Milan) for "Design and experimentation of a KBS developed tool kit for process applications";
- STET-CSELT of Turin for "An architecture for interactive problem solving by cooperating data and knowledge bases";
- CISE of Segrate (Milan) for "Time dependency and system modeling in KBS for industrial process applications";
- STET-CSELT of Turin for "Advanced algorithms and architectures for speech and image processing";
- University of Genoa for "Image and movement understanding";

- ELSAG SpA of Genoa for "Depth and motion analysis";
- Selenia of Rome for "Integrated optic technologies for real time wide band optical signal processing";
- CRAI of Rende for "Knowledge-based user-friendly interfaces for the utilization of information bases";
- CRAI of Rende for "KBS user-friendly system for information bases";
- Delphi of Viareggio for "Message passing architectures and description systems";
- Selenia of Rome for "ARTS-IP satellite data";
- ARG, Applied Research Group, for "Intelligent documents production demonstrator."

Office Equipment—41 projects, in seven of which the leader is Italian:

- Olivetti of Ivrea for "European typewriters and their integration in office automation";
- Olivetti of Turin for "Linguistic analysis of the European languages";
- CELT of Turin for "Local integrated optical network (LION)";
- Industry Face Standard of Pomezia (Rome) for "Ultra wideband coherent optical lan [as published]";
- Olivetti of Pisa for "Construction and management of distributed offices systems (COMANDOS)";
- Olivetti of Pisa for "A multimedia filing system";
- SGI, Societa Generale d'Informatica, of Rome for "Advanced and integrated office system prototypes for European public administration ASTRA"

Computer-assisted Manufacturing, CIM—33 projects, in three of which the leader is Italian:

- Comau SpA of Beinasco (Turin) for "Control systems for integrated manufacturing: CAM solution";
- Eltag SpA of Genoa for "Experimental center for system integration in CIM";
- CSEA of Turin for "Predesign of FMS small batch production of electronics cards."

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Use, Effects of France's Research Tax Credit in 1987

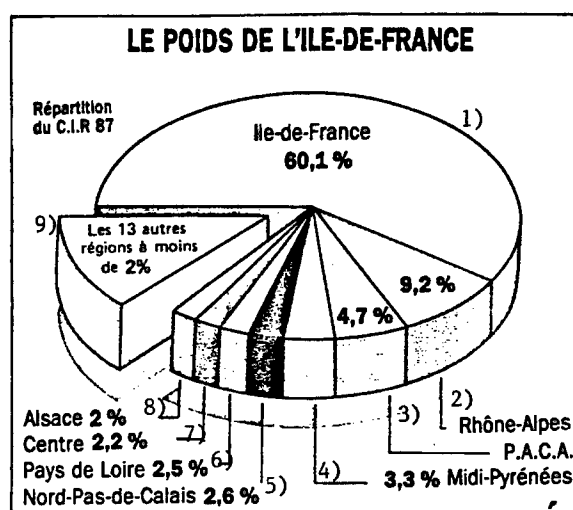
36980331b Paris *INDUSTRIES ET TECHNIQUES* in French 20 Apr 88 p 21

[Article by Gilbert Pointout: "Research Tax Credit: Fr1.3 Billion"]

[Text] A 30-percent increase in 1987. The beneficiaries are 3,500 businesses, including 40 percent of small businesses.

Over Fr1.3 billion for 3,500 businesses: these two figures testify to the success met in 1987 by the research tax credit (CIR) corresponding to 1986 expenditures. And that success keeps increasing. In 1986, only 2,700 businesses benefited from the research tax credit, sharing

about Fr1 billion among themselves. The credit, which allows businesses to deduct from their taxes 50 percent of the increase in research investments over previous year's investments, was introduced in 1983. At the time, it amounted to only Fr350 million distributed among 1,400 businesses. Small businesses are still those which make the most out of this procedure. Businesses with sales of less than Fr50 million received Fr528 as research tax credit, i.e. over 38 percent of the total, although they account for only about 10 percent of French R&D expenditures. Conversely, large businesses (sales over Fr500 million) received only one third of the research tax credit (Fr452 million) although, with over Fr24 billion, they account for close to 75 percent of the French R&D effort.



The Weight of Ile-de-France

Distribution of the 1987 Research Tax Credit

Region	Percentage
1. Ile-de-France	60.1%
2. Rhone-Alpes	9.2%
3. PACA	4.7%
4. Midi-Pyrenees	3.3%
5. Nord-Pas-de-Calais	2.6%
6. Loire Valley	2.5%
7. Central France	2.2%
8. Alsace	2%
9. 13 remaining regions, each less than	2%

Extramural Research: +60 Percent

In 1986, this effort experienced a strong increase over the preceding year, from Fr30.7 billion to Fr36.3 billion. The largest item was still "personnel expenditures" (50 percent of the total). The most significant trend is the development of extramural research, in other words research subcontracted to public organizations or private businesses: Fr5.8 billion in 1986 compared with Fr3.5 billion in 1985, i.e. a 60-percent increase.

Based on the research tax credit, the most active research sectors are still electronics (over 13 percent of the total research tax credit) and pharmaceuticals (10 percent of the total). Taken together, basic chemical, pharmaceutical and chemistry-related industries represent 364 businesses (i.e. about 20 percent of all businesses filing a report) and received Fr224 million in research tax credit (over 16 percent of the total for France).

The "studies/assistance/consulting" sector is also among the very first, as are the mechanics, electrical equipment and engineering sectors. Other sectors lag behind: the wood/paper/furniture industries (Fr15.9 million in research tax credit, i.e. 1.2 percent of the total); the leather/textile/clothing industries (Fr10.5 million or 0.7 percent); and the glass industry (Fr6.5 million or 0.5 percent). As for the building/civil engineering sector, not only is it listed among the last (Fr19.2 million in research

tax credit or 1.4 percent), but it received less than the year before when, with Fr29 million, it accounted for 2.7 percent of the total.

Testifying to the R&D effort, the research tax credit is also a measure of the relative weight of R&D investments in the various industrial sectors. Thus, the average research tax credit per business ranges between Fr130,000 and Fr1.2 million. The leading pack includes the aeronautical industry (average research tax credit of Fr1.27 million), the pharmaceutical industry (Fr880,000), the mining/steelmaking industry (Fr730,000) and the data-processing/office automation sector (Fr720,000). The average for all sectors amounts to about Fr400,000. On the other hand, the research tax credit is modest in the agrifood industries (Fr200,000), the foundry/metal fabrication industries (Fr170,000), the materials/ceramics industries (Fr140,000) and the textile/leather/clothing industries (Fr 130,000).

Electronics a Winner

Sector	Number of Businesses Receiving Research Tax Credit	Research Tax Credit Amount, Million Francs
Electronics	353	182.1
Studies/assistance/consulting	379	135.5
Pharmaceutical industry	129	114
Mechanical engineering	354	86.1
Electrical Equipment	173	75.3
Engineering	214	74.1
Chemical industry	122	67.3
Mining/steelmaking	71	51.7
Automobile	78	50.2
Aeronautical industry	39	49.7
Data processing/Office automation	64	45.9
Research	66	44.9
Chemistry-related industries	113	42.8
Foundry/Metallurgical industry	239	40.5
Precision equipment	96	37.1

Source: Ministry of Research and Higher Education

9294

PASOK Charged with Downgrading of DIMOKRITOS Research Institute

35210122 Athens PONDIKI in Greek 23 Jun 88 p 19

[Text] Since the Panhellenic Socialist Movement Party (PASOK) came to power, for some strange reason it has been against DIMOKRITOS, the research center. Admittedly it is not of the highest level, yet it is not to be ignored, either. It has a certain infrastructure and with some support it could have been improved. However, instead of being supported, from the time the government conceived of the idea of creating an institute of advanced research and technology in Crete, it started downgrading DIMOKRITOS in every way possible.

The biggest effort in the depressing of DIMOKRITOS came from the genius Lianis when he was minister—before he decided that he had the necessary qualifications to be an ambassador. Indeed, if the government

had any sense, it would build an embassy in Greenland and assign Lianis there for life. Others have followed him in the ministry, but Lianis was truly one of a kind.

Now we have had a new case of downgrading, this time at its Institute of Nuclear Physics. Specifically, during recent rating sessions that were held to decide on promotions to various ranks, not one scientist from the DIMOKRITOS Institute of Nuclear Physics was judged suitable for first rank position, 7 were judged for second rank, 8 for third, and once again none for fourth!

As for the other institutes, the following is reported:

- At the Institute of Physics and Chemistry, 14 scientists were judged worthy for first rank, 4 for second rank, 1 for third rank, and 1 for fourth rank.
- At the Institute of the Science of Matter, 2 were judged worthy for first rank, 10 for second, 3 for third, and 2 for fourth.

Why these differences? For the following possible reasons:

- 1. One is the discouragement of nuclear physics research with the ridiculous argument that it does not have practical application in our country.
- 2. Another is personal antagonisms.
- 3. The third is the bad makeup of the ranking and promotions panel.

The ranking and promotions panel has six members, with the result that its chairman has the right to cast two votes, even though his specialty may be different. Furthermore, among the panel members there was not a

single person with specialized knowledge on low or high energy. Even worse was the fact, that one of the members was a candidate along with two others being judged for the position of director of the Institute of Nuclear Physics; when the latter two were downgraded, the former automatically assumed the position.

In a memo to the Ministry of Industry the two scientists are now calling for a new judgment. And if there is no new judgment, they can be anticipated to go to court. And to think that all of this started with someone like Lianis!

5671/08309

COMPUTERS

Status of Remote Access To CEMA Databases Reviewed

23020017 East Berlin INFORMATIK in German
No 3, 1988 pp 82-85

[Article by Rolf Schoefelder, Central Institute for Information Science and Documentation of the GDR: "Status and Prospects of Remote Access to CEMA Databases"]

[Text] Based on their complex program of S&T progress until the year 2000 the CEMA member countries are developing a joint system for automated information exchange. They plan, among other things, the step-by-step implementation of a powerful database network where the databases will be made compatible by the individual CEMA countries or will be made available for mutual interactive searches based on multi-country cooperation within ISWTI [International System for

Scientific and Technical Information of CEMA Countries]. The packet-switched network of the CEMA countries which is under development will be used as a technical basis for communication.

The GDR participates in this project. Facilities were earmarked which are primarily intended to provide databases for international remote access or where subscriber locations for direct access to CEMA databases will be created.

Work in these areas is centrally coordinated by the Central Institute for Information and Documentation (ZIID). To make sure that the technology and organization (exchange) is available for mutual direct access the central office for international automated information exchange was established in ZIID. This article is based on the technical basis of this institute and the experience which has been gained so far with the experimental use of CEMA databases in ZIID.

Technical Prerequisites for Direct Access to CEMA Databases

Table 1 lists the currently used communication basis for direct access from GDR facilities to CEMA databases.

Table 1: CEMA Data Bases Used in Direct Access Mode by GDR Facilities

Sequence	Name of Database Operator/Database	Number of Databases Offered	Typical Content of Database
1	Institute for Scientific and Technical Information of the USSR (VINITI)	55	Natural science and technical areas corresponding to Referativnyj Zhurnal
2	Institute for Socioeconomic Information of the USSR (INION)	13	Areas of social science
3	National Public S&T Library of the USSR (GPNTB)	5	Catalog of literature available in bookstores; EDP-application (programs)
4	Production Association "Patents" of the USSR (NPO "POISK")	2	Trademarks, analogous patents
5	Institute of High Temperature Physics of the Academy of Sciences of the USSR (TVTAN)	1	Factographic database on thermodynamic properties of selected materials
6	Central Institute for S&T Information of the People's Republic of Bulgaria (ZINTI)	8	Selected areas of natural sciences and technology; economics
7	International Center for Scientific and Technical Information of the CEMA Member Countries (IZWTI)	11	As #6; scientific research, environmental protection, CEMA-standards

Until the automated, packet-switched data network of the German Postal Authorities and their international switching nodes are implemented access will be provided by ZIID (central office) as an interim solution. The most important prerequisite is a terminal concentrator (PAD-terminal, Packet Assembler/Dissassembler) which has been in operation in ZIID since November 1986. Its four inputs and outputs can be used by local or remote terminals simultaneously and independently of each other for direct access from GDR facilities to CEMA databases or vice versa to databases in the GDR.

The device implements Rule X.25 of the International Advisory Committee for Telegraph and Telephone (CCITT)¹, i.e. conversion of the character strings sent by

the terminal in the asynchronous mode into standardized character strings provided with an address part (packet) as well as their synchronous transmission to the PAD-terminal on the receiving end. There, the data packets are reconverted and sent to the database as asynchronous data strings. Their response reverses the procedure. Now, the packets transmitted by the other side are converted by the PAD-terminal on location and transmitted further to the target terminal in the asynchronous mode.

This process is controlled by the central switching node of the CEMA data network in the Institute for Automated Systems of the USSR (VNIIPAS) in Moscow. A dedicated line which is currently operated at 2400 bit/s,

but designed for a baud rate of 4800 bit/s, is used as a data connection between ZIID and VNIIPAS.

The remote terminals installed at the subscriber locations and the PAD-terminal in ZIID are connected by data transmission modems approved by the German Postal Authorities via telephone data connections. For these connections, the GDR is permitted to use the manual-switched data network (HDN) of the German Postal Authorities which currently allows for the highest quality data transmission. According to legal requirements² an application for data adapter lines must be submitted to the German Postal Authorities, which will also install them once approved.

During experimental operation of the aforementioned terminal node, which went on for more than a year, successful tests were completed for the following equipment for implementing subscriber location AP 70 (EC 8570), which was set as a standard in the ISWTI-network:

—Hardware: PC 1715 IROBOTRON) or fixed-program terminal VTD 52106 (VIDEOTON, Hungarian People's Republic) each with Cyrillic/Latin keyboard;

—Software: emulator program for telecommunication "TLC" (version: 1.0) in the terminal mode (TALK) with preset program parameters.

- * Device connection (DEVICE) - PC 1715 V. 24 or A or B.
- * Baud rate (SPEED) 300 (bit/s)
- * Character length in bit (BITS/CHARACTER) - 7
- * Number of stop bits (STOPBITS) - 1
- * Parity check (PARITY) - EVEN
- * Transmission mode (MODE) - full-duplex is standard in version 1.0 and is not offered in the menu;

—Modem: VT 60005 (Manufacturer: VIDEOTON, Hungarian People's Republic). The device operates in full-duplex on the 2-wire data lines provided by the German Postal Authorities;

—Printer: K 6311 (ROBOTRON); prints Cyrillic or Latin characters, but only in upper case.

The use of additional hardware and software as well as data transmission technology is being explored.

In general, the use of PC/BC technology is preferable to fixed-programmed terminals since PC/BC technology has the ability to simultaneously store the search results

on diskette. This offers considerable advantages, e.g. for subsequent editing and further processing of results (word processing etc.). For this purpose, additional special software is available.

Availability and Use of CEMA Databases

Compared to 1986³ more than twice the number of databases are currently being offered for experimental use in direct access—altogether more than 100 with an estimated 10 million individual references, including five factographic or factographic-bibliographic fonds. They are offered via 11 databases (centers for the processing of databases), seven of which are partially used by facilities in the GDR (Table 1). The others are operated in the Czechoslovakian Socialist Republic, in Hungary, and in the People's Republic of Poland and in Cuba. In 1988, the GDR will make available at least six on-line fonds for experimental access by interested CEMA partners. Two databases each of ZIID, the Office for Inventions and Patents of the GDR (AfEP), and the Central Institute for Isotope and Radiation Research of the Academy of Sciences of the GDR (Zfi) are earmarked for this purpose.

Currently, ZIID and AfEP regularly participate in the experimental use of the databases listed in Table 1, the Scientific Information Center of the Academy of Sciences of the GDR (WIZ) and the VEP Central Information Processing for Chemistry (ZIC) participate part of the time. The research results obtained—ZIID, for instance, processed 400 interactive inquiries—were used to implement planned information supply tasks or to check the fonds offered and compare their contents with domestic fonds. Another four facilities proved that the subscriber locations created are functioning, and they were able to successfully carry out the first access tests. The plan for 1988 is to include more than 30 facilities in the GDR in the experimental utilization of the CEMA databases using the subscriber locations of these facilities; however, they can only be switched via the PAD-terminal in the ZIID. Until the necessary technical prerequisites have been established, a few of these facilities are using the opportunity to acquire the necessary basic knowledge and skills in international remote data access and to test certain fonds in the CEMA databases with prepared inquiries using the ZIID and its available hardware and software as a basis and under the direction of ZIID experts.

This development creates a broad basis for direct access to CEMA databases via facilities in the GDR, which will be used increasingly on a commercial basis starting in 1989.⁴

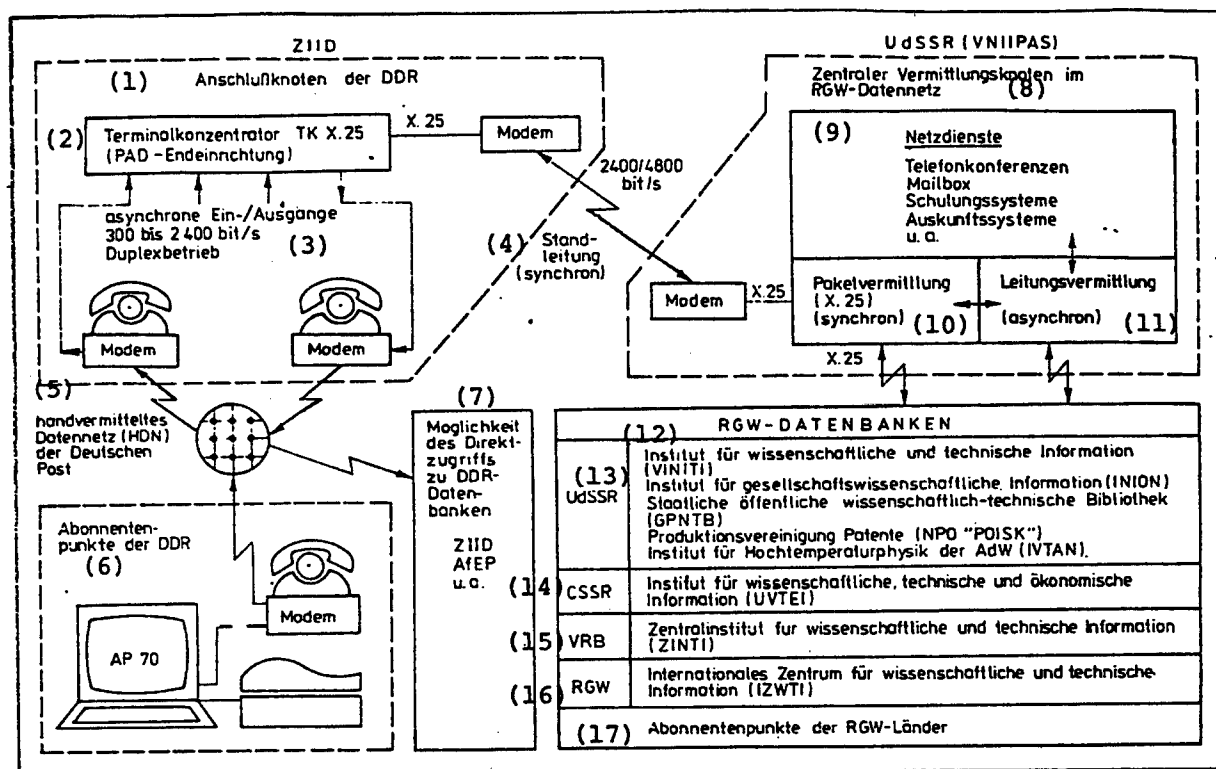


Figure 1. Block Diagram for Remote Data Access to CEMA Databases

Key:—1.GDR connecting node—2.Terminal concentrator TK X.25 (PAD-terminal)—3.Asynchronous I/Os 300 to 2400 bit/s duplex mode—4.Dedicated line (synchronous)—5.Manual switched data network (HDN) of the German Postal Authorities—6.GDR subscriber locations—7.Possibility of direct access to GDR databases ZIID AfEP and others—8.Central switching node in CEMA data network—9.Network services: telephone conferences, mailbox, training systems, information systems, etc.—10.Packet-switching (X.25)(synchronous)—11.Line switching (asynchronous)—12.CEMA Databases—13.USSR:Institute for Scientific and Technical Information (VINITI), Institute for Socio-Scientific Information (INION), National Public Scientific-Technical Library (GPNTB), Patent Production Association (NPO "POISK"), Institute for High Temperature Physics of the Academy of Sciences (IVTAN)—14.Czechoslovak Socialist Republic: Institute for Scientific, Technical and Economic Information (UVTEI)—15.People's Republic of Bulgaria:Central Institute for Scientific and Technical Information (ZINTI)—16.CEMA:International Center for Scientific and Technical Information (IZWTI)—17. CEMA country subscriber locations

Prospects of Remote Data Access to CEMA Databases

The experiments with remote data access which have been carried out confirm that the joint development approach adopted by the CEMA countries is correct. However, a number of technical and organizational problems were recognized the solution of which requires increased efforts of all participants in this country and abroad.

This applies in particular to:

—the scheduled supply of material and technology for the necessary hardware and software, modem technology and data connections to the subscriber locations to be established in the GDR facilities designated for this purpose,

—better utilization of connect time to data bases by

- * increasing the stability of data network elements, preferably the dedicated line connection Berlin-Moscow and the packet-switched and line switching node in VNIIPAS;
- * improving remote data processing technology by increased automation of interactive searches (use of intelligent terminals, data transmission, and similar);

—use of qualified search experts with expanded abilities and skills for international remote access within the CEMA network;

—additional improvements in user friendliness, direct access service, and reliability as well as the fast and

complete availability of the copies and documentation requested from the databases;

—increasing the time the individual CEMA databases are available by

- * providing additional data channels with increased data transmission capability between the switching node in VNIPAS and the databases while increasingly using packet-switched technology (X.25), and
- * better coordination of the databases offered (databases which are used frequently may be relieved by better distribution even including multiple offerings).

By 1990, the number of databases and references offered in the CEMA region will approximately double. The GDR will contribute to this development by providing 15 to 20 accessible funds. The overall share of factographic databases will increase to approximately 10 percent. With the exception of the USSR, the databases offered by each CEMA country will be concentrated in a center for the processing of databases.

We must assume that by 1990 the number of subscriber locations in GDR facilities which are operated for international remote data access will increase to far over a hundred. At least four hours of access time per month must be switched to the databases. In addition, direct access from CEMA country facilities must be switched to the connected funds of the GDR.

In addition to the 8-bit computer technology (PC/BC) which is already available the subscriber locations also use 16-bit technology for automated interactive searches, data transmission, and others.

The density of the packet-switched network of the CEMA countries will increase substantially due to an increasing number of terminal nodes, network nodes and network connection facilities to the automated packet-switched data-networks to be established by the communication authorities of a number of CEMA countries (including the GDR) based on CCITT rule XZ.75.⁴

The development after 1990 will be characterized by additional automation of the international automated information exchange between the CEMA countries. An example is automated database exchange. For this purpose, joint R&D efforts are being undertaken.

Based on automated database analyses and other scientific-metric methods it is necessary to expand the databases offered by the CEMA countries by compatible new and sophisticated funds.

Footnotes

1. Recommendation X.25: Interface between data terminal (DEE) and data transmission device (DUeE) for packet-switched terminals in public data networks. In:

INFORMATIONSHFT DES INSTITUTS FUER POST-UND FERNMELDEWESEN BERLIN. DATE-NUEBERTRAGUNGSNETZE. - CCITT-HEFTE 2990 and 299 d.

2. At present the following apply:

- Law on Postal and Telecommunications of 29 Nov, 1985 (GBI /Law Gazette/ of the GDR, part I No. 31 of 9 Dec, 1985)
- Regulation concerning Data Transmission Service—Data Transmission Rule—of 28 Feb, 1986 (GBI of the GDR SDr. No. 1268 of 18 Apr, 1986.
- Regulation concerning line-dependent telecommunication facilities for non-public telecommunications and the provision of transmission channels, of 28 Feb 1986 (GBI of the GDR, SDr. No 126 of Apr 18 1986).

3. Catalog of the databases made available in ISWTI. - Moscow: IZWTI 1986, 116 p. (in Russian).

4. Recommendation X.75: Control procedures on international transmission channels between packet-switched data networks via data terminals and transit lines for data transmission. In: INFORMATIONSHFT DES INSTITUTS FUER POST- UND FERNMELDEWESEN BERLIN. DATENUEBERTRAGUNGSNETZE. - CCITT-HEFTE 305 c and 305 d.

12831

Hungary's Largest Systems Firm Displays Achievements, Products

25020048a Budapest

COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 7, 6 Apr 88 p 3

[Article by Gitta Takacs: "Systems House—In the Present Tense"]

[Text] At the beginning of March, within the framework of a series of NJSZT [Janos Neumann Computer Science Society] programs, the Computer Technology Applications Enterprise "opened its gates," describing and demonstrating the older and newer professional achievements and products of the firm.

In 1987, the gross sales receipts of the enterprise exceeded 2 billion forints, of which its own sales receipts—the "added value"—came to 1.3 billion and the profit was 110 million forints.

The Szamalk [Computer Technology Applications Enterprise] is the largest systems house in Hungary. They deal with every computer category, many sorts of software and various services, emphasized Miklos Havass, director general. It does all this so that users can get everything—hardware, software, service, training, etc.—from one place. Its marketing strategy has changed. Instead of individual sales—"doling out" software and peripherals one at a time—it wants to sell turn-key systems, integrated user systems made up of domestic

and socialist and capitalist import elements, which requires more working capital and concentrated intellectual capacity, the preparation of which is a task suiting a really big enterprise.

Without doubt the developmental sources for computer technology today are in the capitalist countries, so presence on the international market is important not only because of the dollar income but also because of the "import" of information. In 1982, the Szamalk had foreign exchange receipts worth 13 million forints and although this sum rose to 130 million forints in 1987, the composition of the export was unfavorable. What is characteristic of our domestic software industry in general was also characteristic of them—they can sell only the intellectual capacity of trained experts, but not their products.

The enterprise now offers computers in every category; it is in what can be called a monopoly situation on the domestic market for larger capacity equipment, for discounting the offices in Hungary of a few capitalist firms a domestic computer purchaser can hardly get such equipment elsewhere. In addition to selling computers of socialist manufacture it also deals with renovation and resale of used computers purchased from capitalist countries. These are offered on western, eastern and domestic markets and they also regard it as their task to "mix" hardware coming from various sources, integrating it into a system.

At last year's Budapest International Fair they introduced a 32 bit, 1 MIPS speed computer working with an operating system capable of handling 2 gigabytes of background memory, under the name Mikrosztar 32, in the supermini category. They will be able to deliver it this year. Its applications areas are data processing, office automation, process control and CAD/CAM. So far 40 such machines have found owners, representing 60-70 percent of the domestic market in this computer category.

In 1987, the Szamalk got into the selling of professional personal computers. In the fall months they put about 400 PC's, put together from Chinese subassemblies, on the market and according to the plans they will put 2,000-3,000 XT or AT compatible PC's on the market this year, at a very favorable price.

Beginning in 1988, the firm will no longer enjoy the state support which it received earlier for maintaining a scientific library or helping to train computer experts. Each year the three-year evening and correspondence training organized by the enterprise affects 6,000-8,000 students and in addition it tries to ease the shortage of experts by organizing special study courses, courses for enterprise leaders and—as a new business—teletraining.

The state is also "retreating" from the financing of research and development; no doubt this is why it was said that increasing profit cannot be the absolute goal of

the Szamalk, because as a base institute of the KSH [Central Statistics Office] it must undertake the adoption and domestic spread of modern technological systems and new intellectual values, and this is a task which does not always bring a profit. The Cellware Joint Stock Company was recently formed for the business exploitation of R and D achievements; it is based on results achieved in cell automat research in Szeged (see our issue 1/1988). And in combination with the SZKI [Computer Technology Research Institute and Innovation Center] there is an undertaking going by the name Multilogic aimed at artificial intelligence research and a further development of Prolog.

8984

Hungary: Software Market for IBM PC Compatible Machines

25020048b Budapest

COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian No 7, 6 Apr 88 pp 12-13

[Article by Peter Broczko: "Software Market for IBM PC Compatible Machines; the 1987 Balance"]

[Text] By the end of 1987, the number of domestic computers compatible with the IBM PC increased to nearly 13,000. So our professional microcomputer inventory is increasingly homogeneous and such a mass of computers compatible with one another is already aiding the development of the software market.

In 1987, the assortment of software products intended for the market and sold over the counter expanded extraordinarily, and doubled from spring to the end of the year. We are talking about software goods, about that group of developed programs which have a commodity character (which can be sold "ready to run," which are publicized by advertisements or prospectuses or sold at exhibits, etc.). So we will not deal with the results of ad hoc software development, which belongs more in the service than in the market category.

In the meantime the sale of some software products considered has ended. During the year only one or two dozen such measures were taken every two months but at the end of the year they stopped selling about 150 software products. We can list these in three categories:

- illegally traded foreign software (stopping trade in them indicates an improving public morality);
- out-of-date software, trade in which was no longer considerable;
- programs with unrealistic prices, which since January of this year, with the 25 percent general turnover tax, could hardly be sold any longer and the price of which could not be reduced further—without suffering a loss.

The programs being sold also form three groups according to their use areas. There are general purpose products (including those developed domestically and abroad),

management products, and products differentiated according to their place of use. In some cases these groups overlap but they do break down the domestic software inventory into relatively homogeneous collections.

In 1987, a whole series of modern products, developed domestically, appeared as general purpose software. Let us briefly describe the most significant of them.

Of the database managers appearing last year Hungarian programmers prepared the BECKERbase, in cooperation with the FRG publisher Data Becker. Its possibilities are more modest than dBASE III but the domestic product was prepared primarily for those who are not computer experts. The easily mastered program language resembles BASIC and contains 80 instructions and 18 built-in functions. Sale of BECKERbase began even in the FRG only at the beginning of last year, at an extraordinarily low price of 99 marks. It had a great market success; by May they had sold more than 6,000 copies despite the fact that in the meantime they raised the price to 399 marks.

They began to sell the Senzor database manager on 1 February 1987 and by the end of the year the number of systems sold exceeded sixty. This system, prepared expressly for those who are not computer experts, became popular thanks to its Hungarian language menu and message file. In September of last year it won the right to bear the emblem of the Forum of Outstanding Products—the second program product to do so.

The dMono single-user transactional database manager appeared in November; it is designed to ease entry into the multi-user world. Its functional possibilities precisely correspond to those of dMulti—naturally in a single-user version.

The number of decision support programs expanded gratifyingly last year. By December one could choose from five programs. One of them, the Baba conversational decision preparation, analysing and documenting system, offers many-sided services. In the course of the decision process it accepts the data of the decision analysis, builds a viewpoint graph, provides the weighting and evaluation competence of experts, weights the viewpoints as an expert, grades the decision analysis experts, judges the alternatives individually, combines a group opinion, unites objective and subjective evaluations with converting functions and finally combines the values according to the given algorithm and parameters. It can be used on a service basis also.

The Gratis graphic program package also appeared at the beginning of 1987 and had won real recognition by fall, winning the 100,000 forint first prize at Softwre'88. The program package has 150 graphics instructions and they

can be used in the conversational mode. But its graphic functions can also be called, parameterized, from the user program. Sale of it has begun not only here but also in West Europe.

We could regard 1987 as the year of local networks. The number of firms offering network systems and the assortment expanded in the spring. The most widespread is the Novell network. It was offered on basically two hardware bases. One could get the 1 megabit/s transmission speed PCnet and the 2.5 megabit speed Arcnet. While the NetWare/86 software dominated at the beginning of the year by the end of the year the offering tipped toward the Advanced NetWare/286. At the beginning of the year only S-Core offered a larger, 10 megabit/s transmission speed Ethernet based network but by the end of the year the Instrument Technology Small Cooperative had caught up with it.

The SZKI [Computer Technology Research Institute and Innovation Center] appeared last year with several systems in the area of image processing. The Recognita is a high performance optical character reading system capable of reading in 120 pages an hour—the first step in a complete text processing system developed by the SZKI. It can read very many fonts and as an option one can even change alphabets (Cyrillic, Greek, etc.). Serious interest in the system, which was a great success at the Hannover Fair, has been shown in West Europe also (in the FRG and Austria).

The Prima system of the SZKI is for classic image processing tasks. Its applications areas are evaluation of medical, biological, microscopic photographs, material structure tests, analysis of thermal camera pictures and evaluation of aerial and space photographs.

Qualigraph can be a useful tool primarily for software developers, program quality control organizations and software maintenance sections. An IBM PC version of it has been available since last year. It provides detailed qualitative and structural analysis of the software studied. It analyzes and stores the program structure, filters out superfluously complicated program sections, determines a test strategy and prepares documentation for and a cross-section list of the program in a uniform, quasi-graphic form. It performs a quality check according to nearly 30 statistical characteristics and quantifies the results. With its aid different software products can be compared objectively. It also can be made use of as a service.

The GenT program generator aids preparation of training programs. It was made for teachers without programming knowledge. With the aid of GenT commands placed anywhere in the text the study material can be displayed in the desired form (defining windows, selecting colors and highlights, slowing write-out, etc.). It also aids compilation of tables of contents and indexes and evaluation of answers given to the questions. It also works in a Novell network.

Rexlib, a memory resident extended library, to aid programmers in Turbo Pascal is outstanding among the auxiliary programs. When using it one need write into the program to be translated only a syntactical description of the calls, so translation time is shortened significantly. The program itself can be interchanged without retranslation of the user programs—if we leave its entry points unchanged. A network version can be obtained also.

Of the expert system shells Genesys, developed on a Prolog base, was a new Hungarian item last year.

Because of the difficulties in handling accented letters the preparation of text editors is a domestic task. A new item in the spring was the EkSzer (Ekezetes Szerkeszto [Accented Editor]) program which makes possible convenient editing and printing of Hungarian, Russian and other foreign languages without modifying the computer and printer. It can display nearly one thousand characters. It can be used especially well in the case of complex mathematical texts, superscripted and subscripted formulas and chemical formulas.

A program called Levelezes [Correspondence] provides an ingenious solution for effective aid to foreign language correspondence. When starting it we can work on a text collection containing a thousand Hungarian sentences; a four-language (English, German, French, and Spanish) version is displayed at the same time. From these menu sentences one can then compile a business letter in the foreign language.

The 1986-87 hits of the developed capitalist countries appeared here last year also—office publication editing systems. The first was the Propress system introduced in the spring, the last phase of the SZKI publication editing system, which prepares text in a ready-to-print form. In addition to the traditional screen and matrix printer possibilities it can be used on a laser printer and floppy disk—prepared for a projector. For independent press preparation jobs it is used with a laser printer which, with the swift drop in laser printer prices, makes possible production of camera ready originals for more and more users. A version of the Xerox Ventura Publisher program package, which has reaped success around the world, adapted for accented Hungarian letters is used for press preparation. At the end of last year an automatic word separation program appeared also; it helps break Hungarian language text.

Ventura also constitutes the basis for a complex editing system introduced in the fall by the Instrument Technology Small Cooperative; by the end of the year it had been supplemented by a program to make Hungarian word separations.

The alfaGrafik space informatics system introduced in September 1987 handles mapping and text information in the conversational mode. It can be controlled with 70 commands and 150 subcommands and this instruction set can be expanded further. One can start FORTRAN,

C, Pascal and other language user programs from the system. It can be used widely in technical administration, for example, as a system to manage textual and mapping information, to manage dynamic models of public utility networks, in geological and geographic technology, in regional information systems as a conversational graphics workstation and in computerized designing systems.

Of the security systems the EltGuard won the 25,000 forint third prize at Software'88. Its H version which appeared last year provides 36 hierarchical levels so that only authorized persons can use the programs in the computer.

Trade in domestically developed programs is shown in a table of those with at least three vendors (Table 2). The top ones—with 7-8 vendors—are dAccess III, MicFORTH and Panorama (Views). To a certain extent the table also shows the life curve of software products. One can see, for example, that dAccess III is already declining; the number sold continually decreases, not by chance. At the same time the upswing for Merleg [Balance] is worthy of note; the emblem of the Forum of Outstanding Goods won in the spring certainly plays a role in this. It is striking that Softinvest was the first to sell 13 of the 20 successful programs. This proves a high degree of market sensitivity, good contacts with the developers and agile activity.

But the great majority of general purpose software products sold in Hungary originate in the developed capitalist countries. In this category it is difficult for domestic developers to compete.

Last year the KSH [Central Statistics Office] initiated a procedure whereby general purpose software needed to use professional microcomputers and found throughout the world (system programs, program languages, applications systems) should be imported by the interested institutions not organization by organization but rather within regulated frameworks, officially. In this way the legal rights would be clear and one could get lower prices. Talks have begun—Softinvest with Borland, Novotrade with Ashton Tate, and Szamalk [Computer Technology Applications Enterprise] with Microsoft. Of these the last was successful last year and Szamalk began domestic trade in Microsoft products.

The number of management program packages, controlling enterprise operations, increased extraordinarily in 1987. We have summarized the expansion in offerings in Table 3. The sudden leap at the end of the year in the number of financial systems (payroll, current accounts, general ledger, billing) is especially striking. This was a harbinger of the tax reform; beginning in 1988, as a result of accounting becoming more complicated, the volume of financial work will triple according to estimates. And since manpower is more expensive too the use of microcomputers has become relatively cheaper.

Table 4 shows the number of vendors of software goods. Comparing this to the almost 2,000 domestic firms dealing with computer technology their ratio is still tiny. This proves that individual development, devoting developmental capacity to a large order, is still much better for software developers.

In regard to where they are used we can say of software products that the assortment has increased in the case of branch type program packages. It can be seen from Table 5, illustrating their spread, that "off the shelf" software is appearing in more and more branches. Industry is not shown in the table because general purpose software can be used in industry too—if it was not prepared expressly for a special branch.

Awarding the emblem of the Forum of Outstanding Goods is a new feature in regard to quality. Merleg, offered by Volan Electronics, won the first such emblem in May 1987. The Senzor database management program developed by Senzor and the Rosytext program of the Rolitron Small Cooperative won the right to bear the emblem in September. The latter, as is well known, runs on 8 bit machines. The criteria used evaluate the level of the software so in this way relatively high performance software running on small performance hardware makes it over the "hurdle." The Janos Neumann Computer Science Society takes care of the professional part of the judgment.

The Software exhibit rewards outstanding program products and a prize was awarded for the third time at the time of the fair. We can also count it as progress that every product winning a prize was a program running on a professional microcomputer. The other important factor is that three of the four prize winning products can be obtained "off the shelf." We get a similarly favorable ratio if we look at the character of the prize winning programs. Three were general purpose and one was production control software. The prize offered by Sofinvest also recognizes market success; it is awarded to the most successful product of the period which has elapsed since the preceding Software exhibit. In the first instance it was awarded in two categories—the network designing program package called HSZR-Micro made the most money but the Prizma module was sold in the largest number of copies.

Prices are unformed because the trade in software products is relatively tiny and little software is really sold repeatedly. During the year we could see a selective 10-20 percent price reduction in, for example, the offerings of the SZKI and Data Manager.

In the spring Novotrade started an action to bring down prices. It is already almost a tradition at this firm to always take action on the most timely matters, and to do so very successfully. For example, in November 1985 it began to reduce prices on IBM PC compatible machines; in the fall of 1986, on the first day of the Budapest International Fair, it reduced prices on Commodore-64

programs to half; and at the 1987 spring fair it was the turn of the software products compatible with the IBM PC. It dumped the BECKERbase database manager on the market at a price of 6,950 forints. (At the time the prices for database managers had an upper limit of 420,000 forints and the average was around 100,000!)

As of fall the prices were essentially unchanged, only the prices of some very high priced software were moderated by 10-25 percent, which really did not influence the price level. The simultaneous 10-25 fold price increase for educational programs at the end of the year—suggesting some sort of price cartel—was striking.

One can see from this review that a market for software compatible with the IBM PC did develop in 1987 and the end of the year was characterized by an offering with a suitable composition and number of units.

Table Captions [Tables not reproduced]

Table 1. "Software Compatible With the IBM PC," gives the number of software products on the market, April-December 1987; there were 1,146 in December.

Table 2. "IBM PC Compatible Software Offered by At Least Three Vendors," lists the number of products sold, April-December 1987, by name, also giving the name of the first vendor. The highest figure in this table is eight, attained by dAccess III in April and June and by Panorama in June.

Table 3. "Management Software Compatible With the IBM PC," lists the number of units sold, April-December 1987, by task, such as payroll, billing, etc. The highest figure in this table is 42 payroll units sold in December.

Table 4. "Vendors of IBM PC Compatible Software," gives the number of vendors, April-December 1987; there were 36 in April and 88 in December.

Table 5. "Applications Specific Software Compatible With the IBM PC," lists the number of products, April-December 1987, by place of use, such as health affairs, light industry, etc. The biggest user is agriculture (20 units purchased in April and 29 in December) while purchases for use in trade rose from 4 in April to 23 in December.

8984

FACTORY AUTOMATION, ROBOTICS

Developments in Bulgarian Industrial Robotics Reviewed

23020016 East Berlin FERTIGUNGSTECHNIK UND BETRIEB in German No 4, 1988 pp 214-216

[Article by Dr. D. Dimitrov, Dr. S. Samanov, Scientific Research Institute NIR-Stara Sagora NPSKR - People's Republic of Bulgaria: "Development and Use of Industrial Robots in the People's Republic of Bulgaria"]

[Text] Introduction

More than 10 types of robots are currently produced as standard products in the People's Republic of Bulgaria.

The main producer of industrial robots (IR) is the combine NPSKR "Beroe" in Stara Sagora (People's Republic of Bulgaria). The following manufacturing plants are major suppliers:

—OZZU in Stara Sagora for controls and storage technology

—DSO *Hydraulika* in Kazanlak for hydraulic and pneumatic assemblies.

The integration and specialization which was implemented on a territorial basis provided great benefits for the development and utilization of IR.

The major types of robots are as follows:

1. IR-Series "Pirin", Gantry Version

Due to the many different handling tasks numerous gantry modifications were designed using a modular approach. Four sizes with 10, 40, 80 and 160 kg of handling load are typical of the gantry series.

The gantry robots have the following parameters:

—z-axis stroke length for size 4	250 to 600 mm to 1200 mm
—number of z-axes (arms)	max. 4
—number of gantry carts	up to 2
—gantry beam length for size 4	up to 9000 mm up to 10000 mm
—motion speed (size 4)	0.3 m/s

Gantry robots are used for automatic workpiece insertion into machine tools, heat treatment equipment, equipment for surface treatment, and others, as well as in automated, technological production lines.

2. IR-Series RB 230

These robots work in the cylindrical coordinate system and use hydraulic drives.

Main representatives of this series are the IR RB 231 with a load capacity of 10 kg, and the IR RB 232 with a load capacity of up to 40 kg.

These robots are used with machine tools, foundry machines, diecasting and injection molding machines, heat treatment equipment (handling at the fire furnace), for palletizing stoneware and paper material as well as in the ceramics industry.

3. IR-Series RB 240

The main axes of the IR RB 240 are designed with electro-mechanical drives and work in the cylindrical coordinate system. Gripper axes are driven pneumatically.

The IR RB 242 has a load capacity of 2 x 5 kg and the RB 241 of 2 x 10 kg.

These robots are primarily used with machine tools.

4. Spray Paint Robot

The hydraulically driven spray paint robots RB 211 and RB212 work in the anthropomorphous coordinate system.

The RB 211 (initial development) is equipped with various coating systems (airless, pneumatic, and electrostatic) depending on the type of coating and component shape and dimension. The RB 212 includes a workpiece recognition system as an integral part.

5. Robot Complex RB 251 - "IZATRON"

This complex is used for automating welding processes. According to the MIG/MAG [Metal-Inert-Gas/Metal-Arc-Gas] procedure, non-alloyed and alloyed steels or aluminum alloys can be welded.

6. Pneumatic Industrial Robot RB 112

The RB 112 is equipped with two arms and works in the cylindrical coordinate system. This robot is suitable for use at forming machines (cold extrusion) with short processing times.

It is produced in different versions depending on the manufacturing and handling tasks.

Grippers, modules for local movements (MLB) and peripheral auxiliary devices (PHE) are available as options. These options complete the robot functions. In some cases, they improve the technical parameters, such as positioning accuracy. Optimal distribution of functions among the different devices is very important for efficient IR use. In many applications, the gripper and peripheral modifications are essential. Gripper and peripheral development and adaptation are part of the design and planning work at the Scientific Research Institute NIIR - Stara Sagora NPSKR.

7. Gripper Solutions

The research institute uses the modular approach to develop various series of gripper types, modules and PHE for different technological applications. The areas of application of the IR which are produced as standard products are so broad that new grippers and devices must be continuously developed.

Figure 1 shows the IR RB 112 with two arms, which is a special machine for processing small prismatic workpieces with a cycle time of 18 s. Figure 2 shows the magazine. Workpieces for at least one shift can be stored.

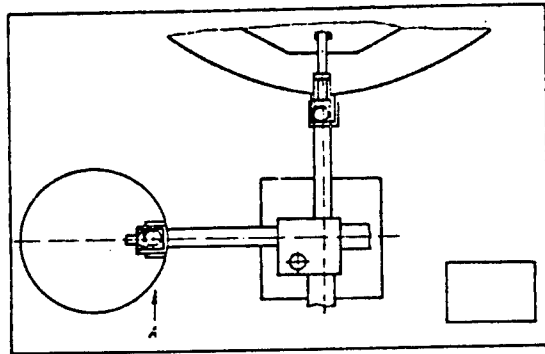


Figure 1. Pneumatic Industrial Robot RB 112

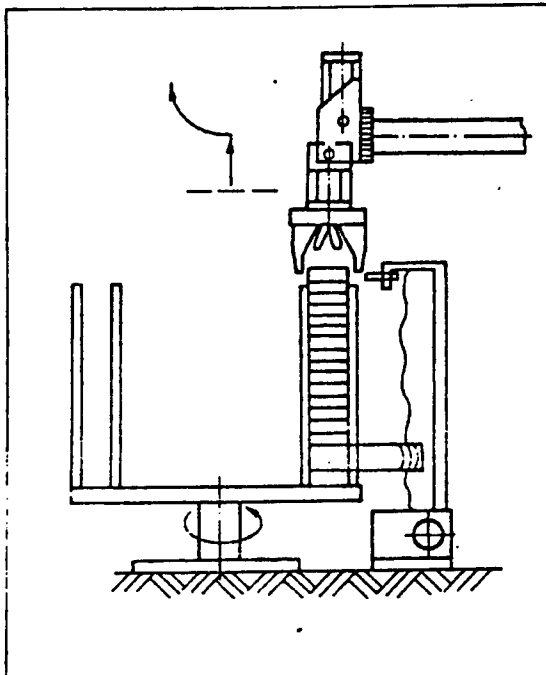


Figure 2. Magazine

Figure 3 shows a special gripper solution. The gripper shown in figure 3 manipulates, for instance, auto tires.

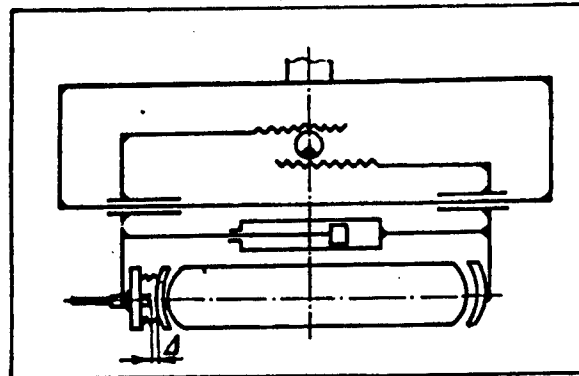


Figure 3. Special Gripper Solution

The IR positioning accuracy is 0.4 mm. The gripper for light-weight workpieces shown in Figure 4 can be used under the following conditions:

- the machine must have horizontal spindle axes
- workpieces must be located on the magazine with their vertical axis

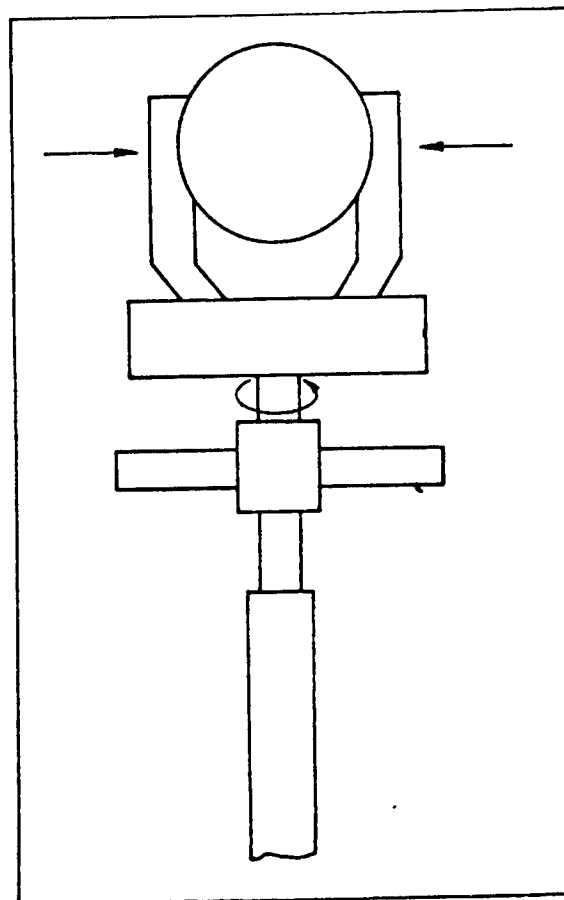


Figure 4. Gripper for Light-Weight Workpieces

For very heavy workpieces the gripper shown in Figure 5 is used. The workpieces can be pressed into the jig by:

- the gripper with a built-in pressing mechanism, and with
- external pressing devices.

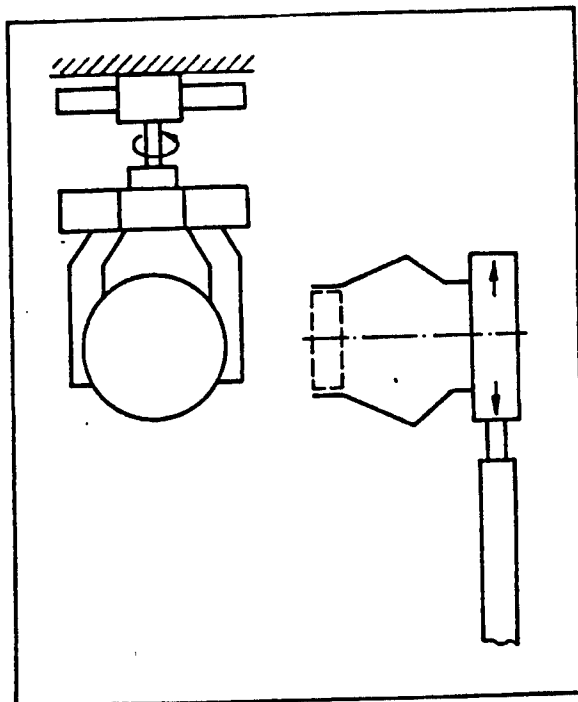


Figure 5. Gripper for Heavy Workpieces

For external pressing devices, model designs are available to save planning time. For one-arm robots double grippers are used to avoid idle times. The use of multi-position grippers is suitable for many applications, e.g. for depalletizing, from a single-row transporter to a multi-position magazine (Figure 6).

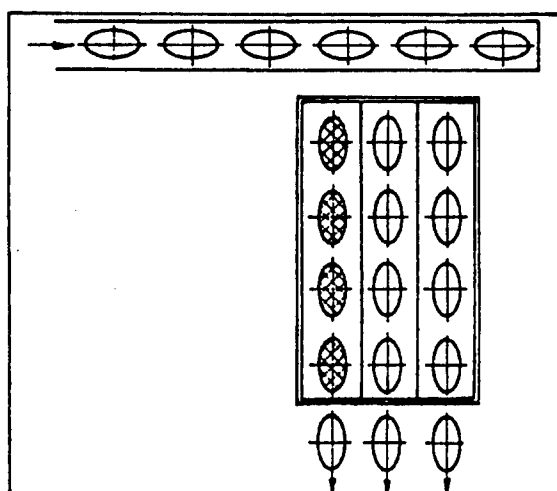


Figure 6. Repalletizing from a Single-Row Transporter to a Multi-Position Magazine

Figures 7 and 8 show gripper solutions in combination with workpiece magazines. Figure 7 shows an electro-magnetic gripper without moveable gripper fingers. This gripper is suited primarily for smooth circular parts and prismatic parts. The pallets can be densely packed.

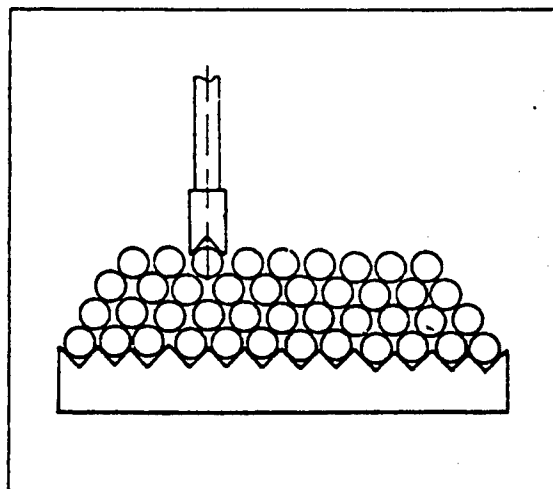


Figure 7. Electro-Magnetic Gripper Without Moveable Gripper Fingers

Tong grippers (Figure 8) are used for separate, rotationally symmetrical parts, forged parts, and non-magnetic materials. A disadvantage of this solution is the low packing density on the magazine.

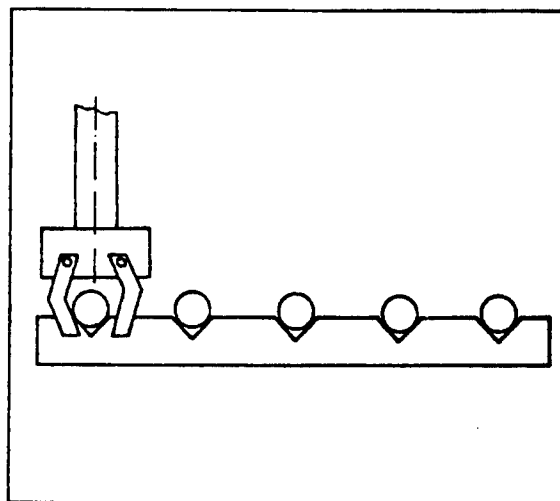


Figure 8. Tong Gripper for Separate, Round Parts, Forged Parts, and Non-Magnetic Materials

8. Workpiece Storage Units

The design of workpiece storage units depends on the size of the series and the number of work operations which have to be performed on the workpiece as well as on the TUL [Transport, Transfer and Storage] organization.

The circular and oval transfer storage units (Figure 9), for instance, are suitable for short series and for workpieces with maximally two operations.

The workpieces are stored on the cart with simple stopping devices or directly on the cart surface. Rectangular pallets are used increasingly to automate production completely.

The pallets can be transported by crane, shelf servicing devices, robocarriers, and others.

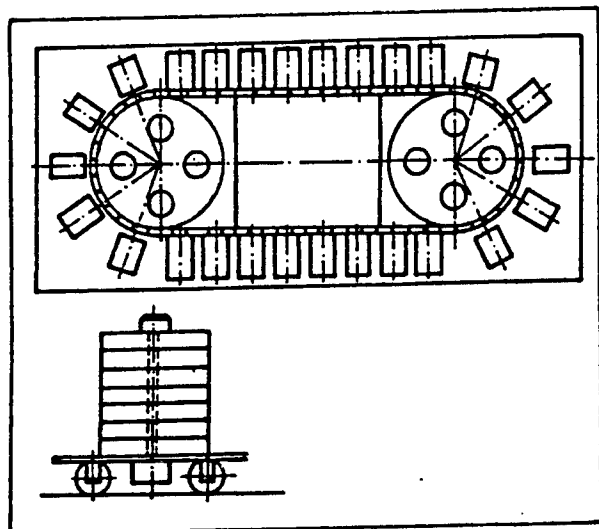


Figure 9. Circular and Oval Transfer Storage Units

Figure 10 shows a newly developed storage unit for rectangular pallets. The parts are arranged in rows. This

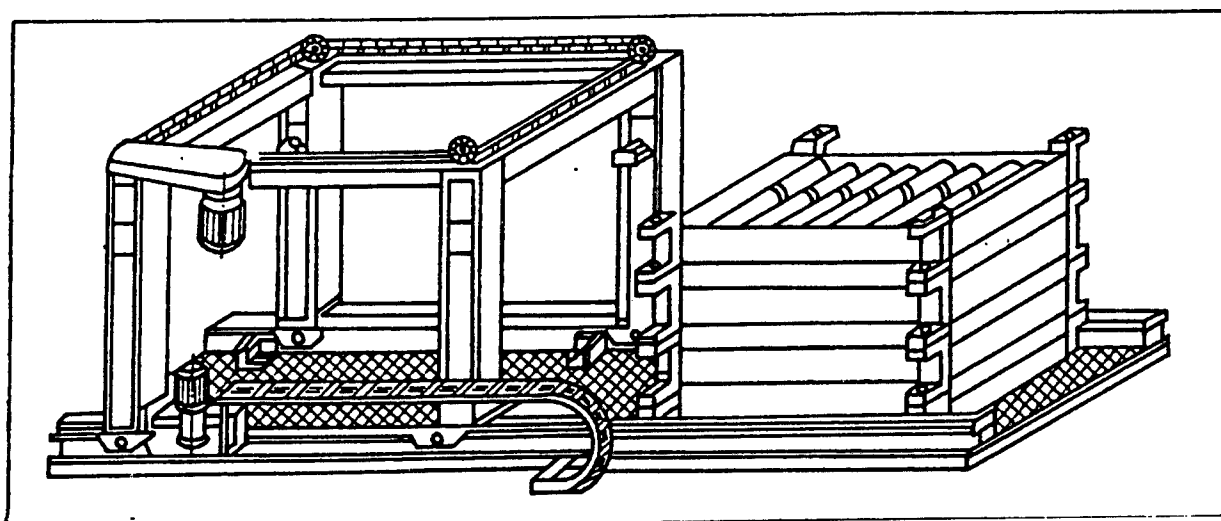


Figure 10. Storage Units for Rectangular Pallets

form of storage device is used in combination with gantry robots (load capacity 80 kg).

Pallet size is 1200 mm x 800 mm.

9. Development Trends

Two robots with a modular design are under development.

The gantry robot RB 281 is designed with a stroke length of 800 mm and a load capacity of 25 kg. The vertical arms can be swivelled. All axes are electromechanically driven. The RB 281 is intended for use with machine tools.

The second robot is produced for use with plasma cutting machines IZA-G-44 for cutting 2000 mm x 1500 mm x 5 to 6 mm large sheet metal pieces. The plasma cutting machine is produced in the WPW combine for welding technology, Sofia.

The drives are based on high-torque D.C. motors with torques of 0.98 to 34.3 N/m and gear drives with a gear ratio of 80 to 386 and a torque of 10 to 1600 N/m. This drive technology is produced in an NPSKR operation.

In conclusion it can be said that the People's Republic of Bulgaria develops and produces industrial robots, grippers and peripheral devices for automating the workplace and production processes and for various applications (ATL [Automatic Test Line] and AFS [Automated Manufacturing Controls]). (Translator: Dr. H. Scheibner, Research Center for Machine Tool Building).

12831

Hungary: CAD/CAM Training System at Raba Factory

25020047 Budapest

COMPUTERWORLD/SZAMITASTECHNIKA in
Hungarian No 7, 6 Apr 88 p 2

[Article by Tamas Kolossa: "The Best Investment"]

[Text] However we evaluate it, Raba is satisfying the law of "show business"—we hear a lot about it. Most recently they raised a lot of dust with the announcement that because of the limitations imposed by the domestic regulators, they were leaving the consortium preparing for auto manufacture. There were those who evaluated this as a lack of entrepreneurial spirit. Others saw in the automobile a substitute symbol....

Raba's response was not long delayed. On 11 March they demonstrated for representatives of the press the first CAD/CAM training system to be developed in our country. They thus proved that sometimes they were inclined to take on a sort of mission.

In essence the training system is a small flexible manufacturing line controlled by computers. The Austrian EMCO firm recently put together the system linking small metal cutting machines, robots, and computers. Even earlier Raba had purchased some numerically controlled table lathes and milling machines so now it was enough to supplement the set to a value of 1.5 million schillings. (We described the EMCO equipment more amply in our issue 19/1987.)

They demonstrated two small model systems in the modern training center of the enterprise. AutoCAD works with a high resolution monitor, a plotter and a digitizing table, connected to a peripheral which is still unusual—the EMCO CNC lathe. So one can not only prepare drawings and plans from the AutoCAD files and the EmcoDRAFT program of the EMCO firm, one can also prepare real parts. The CAD/CAM station differs from large manufacturing systems only in its output capacity, thanks to which one need not fear mistakes causing extensive damage.

Similarly, the model of a flexible manufacturing system offers experience in realization which cannot be replaced by anything. The series manufacturing technology for parts designed at the former station can be planned on another IBM type PC. The result can be forwarded via a PC based control to the serving robot, a lathe and a milling machine. The flexibility of the system derives not only from the high degree of automation but even more

from the possibility of simplifying a switch to the manufacture of various products with the easy exchange of different processing programs.

One can find very few flexible manufacturing systems in our country today; and very few domestic engineers attend schools for computerized parts and manufacturing design. Raba plans to put the first large manufacturing system into operation by 1990. But this year already this will be preceded by a five workstation CAD/CAM designing system based on a KFKI [Central Physics Research Institute] TPA 11/580 computer; it will be used first for parts and manufacturing design of forging dies. They need a training system so that when the large plans are realized the thousand engineers and several thousand technicians and skilled workers of Raba will know their tasks.

It must be added that Raba is also a pioneer in other areas of industrial use of computer technology. They are developing a comprehensive system for enterprise and production control on their IBM system large computers. The atmosphere of the demonstration held in Gyor showed that they seriously think that training is an investment which will pay off quickly, and that a possibility for structural change in industry must be sought not among the regulators but rather among modern machines.

8984

METALLURGICAL INDUSTRIES

Developments in Czech Continuous Casting Technology

Ladle Treatment Applied

24020017 Brno HUTNICKE LISTY in Czech
No 4, 1988 pp 239-243

[Article by Eng Oldrich Volny, candidate of sciences, Eng Milan Jansky, Miroslav Vasicek, Eng Bretislav Pelucha, Institute for Ferrous Metals Research, Dobra, and Eng Alexander Laluska, Sverma Steel Plant, Podbrezova: "Extrafurnace Processing of Continuously Cast Steel"]

[Text] A suggested technology for extrafurnace processing of steel destined for the production of seamless tubing made from continuously cast blanks. Description of technical equipment built to realize this technology at the Sverma Steel Plant in Podbrezova.

Extrafurnace processing of steel encompasses technological processes involved in the treatment of steel which are accomplished in the steel-making ladle either during the course or after completion of tapping the steel from the steel-making furnace. Currently, an entire series of processes of extrafurnace processing procedures are known which have as their goal the attainment of specific quality parameter improvements of the steel

involved. These are vacuum production processes, blasting of pulverized additives to promote desulfurization, to complete the alloying process, etc.

At the work site where extrafurnace processing of steel takes place certain uniform characteristics of the steel must be achieved prior to its being cast, both with regard to its temperature, chemical composition, as well as micropurity and other parameters. These uniform characteristics must be achieved both during the course of a single heat, as well as in different heats of the same brand of steel being cast, particularly with respect to sequentially cast heats. At the same time, it is desirable to achieve improvements in the technological characteristics of the steel from the standpoint of their processing within the metallurgical plant. That is why the technological process of ladle treatment for steel was proposed for use at the Sverma Steel Plant which follows two principal goals:

1. Adjusting the steel from the standpoint of the requirements emanating from the character of its casting involving continuous casting equipment;
2. Adjusting the steel from the standpoint of improving its technological characteristics during subsequent processing, that is to say, during the production of tubing.

The Influence of Extrafurnace Processing Upon the Continuous Casting Process

Steel intended for continuous casting is subject to higher quality requirements than steel intended for casting in molds. The system of sequential casting, which is also used at the Sverma Steel Plant at Podbrezova, requires the temperature and chemical standardization of different melts. This leads to the absolute necessity for a thorough homogenization of the steel in the ladle through the use of inert gas, which is also an important prerequisite for the successful use of probes to measure the temperature of the steel, to determine oxygen activity, and to take metal samples, as well as the attainment of reproducible results. Given these prerequisites, it is possible to use the measured magnitudes for the direct control of technological processes.

A component of standardizing parameters of steel is also the carrying out of the temperature adjustment of the steel at the conclusion of the extrafurnace processing stage so that the steel would be delivered to the continuous casting site within the narrowest of temperature variations and showing an optimum degree of superheating above the temperature of the liquid. Adjusting the temperature also makes it possible to deliver the first heat in the sequence at a higher temperature to cover temperature losses caused by higher accumulations of heat in the lining of the intermediate pony ladle. Another essential provision is the improvement of the micropurity of the steel. Nonmetallic inclusions which are present in liquid steel remain in continuously cast hearth accretions and are no longer removed by trimming.

Therefore, it is necessary to include a second phase of argon gas purification using lower gas flow rates in the technological process; during this phase, a light stirring of the steel by the argon gas takes place (nitrogen can also be used) and this facilitates the floating out of nonmetallic inclusions from the steel to the slag-metal boundary.

The achievement of an adequately strong casting skin—and, thus, also the attainment of higher outputs in continuous casting, is dependent, among others, on the good deoxidation of the steel. Although stronger deoxidants exist, aluminum will obviously remain the principal deoxidant in steelmaking for a long time as a result of its economic advantages and some technological advantages (high degree of solubility in steel). The residual content of melted aluminum (0.02 percent) in steel represents an adequate supply of aluminum in the steel which assures the elimination of the undesirable influence of oxygen as well, which penetrates into the steel during secondary oxidation, that is to say, particularly during reladling of the steel from the ladle to the pony ladle and, possibly, also from the pony ladle to the crystallizing pan. The introduction of submersible tubes, shielding tubes, and some other measures applied in the pony ladle restricts secondary oxidation and makes it possible to utilize lower quantities of molten aluminum in steel.

Aluminate inclusions which arise during deoxidation with aluminum create operational problems. In view of their high melting point and widely branched dendritic shape in their solid state, they settle readily in the area of the ladle's teeming nozzle, which becomes blocked. This results in interrupting casting with subsequent burnout of the teeming nozzle by oxygen, which in turn has an adverse effect on the continuity of the casting process and on the quality of continuously cast products. Therefore, an essential condition for using deep deoxidation with aluminum prior to the continuous casting process is the subsequent carrying out of the modification of aluminate inclusions and, thus, the suppression of their negative influences upon the casting process. For purposes of modification, it is possible to use SiCa. Figure 1 [not reproduced] shows a balanced $\text{CaO-Al}_2\text{O}_3$ diagram. For purposes of modification, it is necessary to achieve fluid inclusions which float out well, that is to say, inclusions which have a lower melting point than the temperature of the liquid steel. According to the diagram depicted in Figure 1, these characteristics are met by inclusions containing Al_2O_3 within limitations of roughly 40 to 60 percent. Inclusions of this chemical composition can be removed from the steel in the process of blasting with inert gases and the micropurity of the steel can thus be improved.

By including the second phase of argon gas purification, not all nonmetallic inclusions are removed from the steel. The chemical composition of the inclusions remaining in the steel are influenced by their fluidity according to the relationships depicted in Figure 2 [not

reproduced]. From the diagram it can be seen that the highest degree of fluidity of the steel is achieved when the ratio of Ca/Al is greater than 0.14; if the ratio of Ca/Al is lower than 0.14 in the area where $\text{CaO} \times 6\text{Al}_2\text{O}_3$ inclusions are formed, the liquidity of the steel is lower than before the addition of modifying substances.

For purposes of final deoxidation and modification, therefore, it is necessary to use such methods of adding these substances which would facilitate the precise control of the process and the attainment of well-reproducible results.

Influence of Secondary Metallurgy Upon the Quality of Steel Used in the Manufacture of Tubing

The technological process of producing tubing is characterized by a high degree of deformation of the steel and a change in the direction of flow of the material during punching and the subsequent elongation process. The resistance of the material to failure during the course of tube formation grows as the degree of isotropic plastic characteristics of the formed material increases. Figure 3 [not reproduced] shows the dependence of isotropic plastic characteristics of bar steel, determined as a ratio of reduction during tensile strength tests with the draw sample taken in a longitudinal and transfer direction along the entire length of its sulphidic inclusions. The high value of the coefficient of the correlation attests to the relatively close dependency. Furthermore, using low-carbon steel, the dependency of formability, measured with a torsion plastometer and involving inclusions greater than 4 micrometers.

$$Y = 192.8 - 0.33 \times X,$$

where Y = deformation to fracture (percent); X = number of inclusions greater than 4 micrometers.

In other words, modification is needed to achieve inclusions which are less than 4 micrometers in size and which have a high degree of hardness not subject to deformation during the formation of the steel product. The influence of the content of limestone in MnS inclusions is documented in Figure 4 [not reproduced]. With a growing content of CaS in MnS inclusions, the hardness of the inclusion grows and, thus, their resistance to deformation, particularly at higher temperatures.

For purposes of judging the possibilities of changing the morphology of aluminate inclusions, the Sverma Steel Plant at Podbrezova experimentally tested the introduction of shapes filled with SiCa into liquefied steel in the ladle with the help of a mechanical feeder. In contrast to current technology, which calls for the introduction of 80 kg of SiCa into a 50-ton melt of low-carbon steel in the ladle prior to tapping, only 52 kg of SiCa in the form of SiCa-filled shapes measuring 8 x 28 mm were introduced following prior deoxidation with aluminum.

Through the influence of the addition of SiCa, the size of inclusions diminished. The average magnitude of inclusions declined by 64 percent. The number of inclusions measuring 5 or more micrometers (which exert a negative influence on the shapability of steel) declined by 88 percent. The influence of limestone was manifested by an increase in the number of inclusions of the smallest dimensions. The number of inclusions up to 2 micrometers in size increased by 66 percent; that of inclusions up to 3 micrometers in size, by 47 percent.

The utility of the system of adding SiCa is proven by the growth in the content of limestone in the inclusions. From the basic average content of limestone in the inclusion mass, which amounted to 2.6-2.8 percent of Ca, the content rose to 22.4-34.5 percent after modification, that is to say, by approximately a factor of 10. The utilization of Ca contained in the added SiCa, which reached a level of 7 percent, was correspondingly high.

Modifying the character of inclusions by this method exerted a favorable influence upon the technological characteristics of the steel. Rejects in the production of tubing declined to less than half the number occurring during the current production method.

Other experiments conducted in the 100-kg induction furnace proved the favorable influence of the growing volume of Ca in inclusions upon lowering their plasticity. This influence grows with the temperature of deformation—see Table I [not reproduced].

From the experiments which were conducted, it is clear that the method of modifying inclusions by adding SiCa in the form of filled shapes represents a very effective procedure which exerts a favorable influence upon the character of the nonmetallic inclusions and, thus, also upon the quality of the steel for purposes of making tubing.

On the basis of an analysis of the requirements for quality of steel for continuous casting and for the technology of tubing production, the technological process depicted in the form of a developmental diagram in Figure 5 [not reproduced] was devised. To accomplish it, it was proposed that an extrafurnace work site for processing of steel be set up and it was established at the Sverma Steel Plant in the continuous casting shop. Here, steel from electric-arc furnaces in melts of 40 tons each and from open-hearth furnaces in melts of 50 tons each will be handled.

A view of the work site for extrafurnace processing is shown in Figure 6 [not reproduced]. The basis for the work site is formed by the two-level steel platform. The principal work site is located at an elevation of more than 3.3 meters; the auxiliary platform is at an elevation of 5.8 meters and the crane track for the auxiliary crane is at 9.8 meters. Through the use of an auxiliary crane, the entire work site became independent of the other cranes located in the shop.

For the principal technological functions, that is to say, for the deoxidation and modification, use is made of wire feeders. The feeder located in the immediate vicinity of the control booth is intended solely for feeding aluminum wire. It is a single-strand feeder with a constant feeding speed of 5 meters/sec⁻¹. The wire is 12 mm in diameter and the spool weighs 1 ton. The system for spooling off the wire is nonrotational and takes place from the elevation of 0.0 meter (beneath the working platform). In view of the use of a tiltable ladle lid, the entire feeder mechanism will move along a horizontal track from its at-rest position to its working position at which the introduction nozzle lines up with the opening in the ladle lid. Control of this movement is accomplished from the control console, which is located in the control cabin.

The actual technological functions of the feeder are controlled by an SAPI-1 microcomputer. The programming makes it possible for the servicing crew to provide

the required quantity of aluminum necessary to be added to the steel by way of a dialogue. The actual startup and stopping of the machine is accomplished by the microcomputer upon orders from the crew. Following the experimental accuracy adjustment of the controlling mathematical models, the microprocessor will be connected directly to the probe for measuring oxygen activity, will perform the calculation of the necessary quantities of aluminum which must be added, and, upon approval of the operating crew, will perform this operation. In verifying the feeding of aluminum wire into the steel with the aid of a feeder, 60 percent of the available aluminum was utilized. For the addition of castings filled with modifying substances, a feeder having the following parameters was developed in cooperation with the Trinec Iron Works (of the Great October Socialist Revolution):

Speed of feeding	0-6 meters/sec ⁻¹ —continuously controllable with 4 preselectable speeds
Number of parallel-fed castings	2
Control system	Manual, with preselection by machine or SAPI-1 microprocessor from the control cabin
Dimensions of castings fed	Thickness—maximum 20 mm, minimum—5 mm, width—maximum 30 mm

The system of controlling the modification feeder by a microprocessor is similar to that used in the feeder for aluminum wire. Mathematical models will also be used to determine the quantities of modification substances to be used. For a given brand of steel and for the existing production conditions in the steel mill, data on actual chemical composition of the steel, on oxygen activity, and on the quantity of added aluminum will lead to the establishment of optimal admixtures of modification substances. The operating crew will once more take over only control functions.

Modifying admixtures will be added to the steel in the form of filled shapes. During the first phase, that is to say, in the years 1988-1989, a shape measuring 8 x 28 mm and having a shell measuring 0.2 mm will be used. This shape will be wound on spools and will require a rotation type of unwinding. Later, a circular shape will be produced which will facilitate the attainment of a greater mass of the coil and, in turn, will allow the use of nonrotational unwinding.

For purposes of measuring the parameters of liquefied steel, the work site of extrafurnace processing of steel has an independent work location. A manipulator will facilitate the making of independent oxygen action measurements, temperature measurement, or will take samples of the metal. It will be controlled by the operating crew from the control cabin with the assistance of a control console. The system facilitates the movement of a probe from its at-rest position to its measuring position, the sojourn of the probe in the melted substance for an unprogrammed duration, and the extraction of the probe into its at-rest position once more. A part of the system

is also a measuring circuit control device. The work site is augmented by an installation for separating a probe with a sample of the metal and a hydraulic system for pushing the sample of metal out of the probe which is being cut apart. Furthermore, in the vicinity of the manipulator there is a tempering box for storing operational supplies of probes under constant temperatures.

Argon blasting to homogenize the bath and to float out inclusions will be carried out by a porous mold located at the bottom of the ladle. Its location was solved within the framework of the proposed new ladle lining in such a way as to assure the highest operational reliability of this particular component. The blasting gas is divided into two independent branches (homogenization and floating out of inclusions); both are equipped with special flow regulators which make it possible to maintain the required immediate quantity without regard to the permeability of the porous mold. Argon blasting is controlled from the control panel which also has time switches to assure blasting for the required duration.

The work site for extrafurnace processing of steel will not be equipped with facilities for heating steel in the ladle. That is why the temperature regime is given so much extraordinary attention. The ladle is equipped with a layer of insulation refractory material and the working layer is made of highly clayey building material. The use of high-temperature heating to heat the lining to approximately 1,000 degrees Centigrade required the installation of a sliding valve closure. In designing the system of extrafurnace processing, use was made, among others, of the mathematical prediction model of the temperature regime of a ladle developed by the Institute for Ferrous

Metals Research. This model made it possible to stipulate the optimum lining for a steel-making ladle and the lid, the magnitude of tapping temperatures in optimizing the technological process of extrafurnace processing of steel, and facilitated the prediction of steel temperatures in dependency upon the time of its sojourn in the ladle. Utilization of the prediction model made it possible to minimize the extent of operational experiments and, thus, to lower the costs of the solution.

The design of the extrafurnace steel processing work site from the standpoint of adjusting the temperature of the steel is based on the assumption that the steel will be delivered to the work site always at a temperature which is higher than the minimum required temperature. The final operation, that is to say, the fine blasting with inert gases, will be carried out according to the requirements stipulated for lowering temperatures; either with the ladle lid closed—minimum temperature losses; or with the ladle lid open—higher losses; or possibly with simultaneous submersion of a steel blank of the same quality as that steel which is being produced—the highest temperature losses. The degree of cooling will be determined by computation on the basis of measurements of the actual temperature state of the liquid steel in the ladle—see Figure 5.

The equipment at the work site for extrafurnace processing of steel is augmented by the addition of a hinged ladle lid and suction tubing. All functions at the work site of extrafurnace processing of steel are controlled from the control cabin located on the 3.3-meter platform—see Figure 6 [not reproduced]. The control cabin measures 3 x 5 meters, is air-conditioned, has central and local lighting whose intensity can be controlled to eliminate reflections from the windows. The control console has a "mosaic"-type control panel measuring 600 x 400 mm. Additionally, there are two Model SAPI-1 microprocessors and monitors to control the feeders. A teletype machine is within reach of the operating crew for communication with the quantification station.

The control cabin also has a cabinet containing measuring instruments which control and regulate the elements of inert gas distribution.

Conclusion

The extrafurnace steel processing work site established at the Sverma Steel Plant at Podbrezova facilitates the fundamental technological operations, the homogenization, the terminal deoxidation, the modification of non-metallic inclusions, the increase in micropurity, and the adjustment in the temperature of steel prior to its introduction to the continuous casting facility. The purpose of the technological process is to eliminate difficulties in casting caused by the progressive blockage of the ladle pouring spout, improvement in the quality of continuous cast blanks and the technological characteristics of steel during the subsequent fabrication of tubing. The laboratory and operational experiments which

have been undertaken confirm the high efficiency of the proposed system which involves the feeding of aluminum wire and filled shapes into liquid steel—factors which, when combined with the increased quality of the steel, exert a positive influence on the economic results of the entire work site. The feeders for aluminum wire and filled shapes create the technical conditions for the utilization of computer technology in the direct control of the process of deoxidation and modification of non-metallic inclusions.

The control system for the feeders makes it possible not only to have the operating crew exercise direct control in the form of a dialogue, but, following the hooking up of oxygen activity control probes to the computer and to the output ports for the chemical composition of steel, also facilitates the automatic computation of the quantities of deoxidants and modifying admixtures. In this case, the operating crew fulfills merely control functions prior to the actual automatic dosing of admixtures into the steel.

The design of the work site is selected in such a manner that the equipment, including the control system, may be used without fundamental changes even in conjunction with a ladle furnace, the essential need for which by several metallurgical enterprises in Czechoslovakia is not in doubt.

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24020017 Brno HUTNICKE LISTY in Czech
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[Eng Zdenek Fojtik, Eng Leopold Cudzik, Hynek Brazda, doctor of natural sciences, Research Institute for Ferrous Metals Research, Dobra: "Development of Measuring Methods for a Radial-Type Continuous Casting Mold Facility"]

[Text] Experimental measurements under continuous casting operation conditions of the radial type with the goal of establishing dependency between the size and course of friction forces in the ingot mold upon the kinetic temperature field of the ingot mold. Adjusting the technological axis with the aid of an optical sight.

The importance of solving the problem of automation pertaining to continuous casting installations is stressed by the state plan for the development and creation of continuous casting facilities as well as by having the problem of automation of continuous casting included in the Comprehensive Plan of Scientific-Technical Progress.

The greatest problem in the area of automating continuous casting facilities in Czechoslovakia is likely not the shortage of suitable computers and computer technology at all, but, clearly, inadequately developed measuring methods and, primarily, the absolute shortage of suitable special sensing units which are specific to continuous casting.

It is possible to find temporary solutions to automated continuous casting by importing instrument technology from leading world producers. This primarily involves sensing units or possibly entire systems for measuring and regulating the level of the steel surface in the ingot mold, measuring and regulating the level of steel in the pony ladle, instruments to indicate the presence of slag in the stream of steel which is protected by a shielding tube, measuring devices for the surface temperature of blanks, measuring devices for measuring temperatures in the secondary cooling region, systems for the diagnosis of correct ingot mold activity, systems for controlling secondary cooling, etc.

The effects of failing to equip continuous casting facilities with these sensors and systems are manifest not only during the actual continuous casting operation, but have a direct effect on the quality of production and lead to greater problems in developing domestic technologies for casting higher quality types of steel.

Apart from characteristic metallurgical and thermotechnical parameters, the control process must also include signals which evaluate the correct function of machines which, in turn, makes possible the anticipation of defects and deviations from standard operations.

Existing continuous casting facilities in Czechoslovakia do have a number of various sensing devices and some auxiliary regulating circuits. However, they lack the most important regulating systems from the standpoint of continuous casting for controlling the level of the liquid steel and the measuring method (including its instrumentation) which would facilitate the stabilization of the working conditions of the ingot mold, whose correct action exerts a fundamental and decisive influence upon the entire process of casting and particularly upon the surface quality of the ingot, is not adequately developed.

The determination of appropriate working conditions governing the operation of the ingot mold, that is to say, the speed of casting, the frequency of ingot mold oscillations, the intensity of ingot mold cooling, the type and quantity of the casting powder used, the magnitude of the ingot mold frequency swing, etc., is an important

condition for the trouble-free operation of the continuous casting facility, for assuring the adequate output of the machinery, and for attaining the desired quality of blanks.

Quality defects such as a rhombic ingot cross section, surface fissures, subsurface fissures, deep oscillation wrinkles are generally connected with the ingot mold operating conditions, with its mechanical design, with the kinetics of the temperature field, and with ingot mold wall deformations, both plastic and dynamic in character, which occur in the course of casting.¹

Knowledge regarding the relationship between the design of the ingot mold, the operating conditions, and the quality of production is so inadequate that product quality—involving not only domestic installations in this country—is achieved by the trial-and-error method.

Research work in this area is intended to produce instrumentation and result in such methods of measuring as would make it possible to establish and control suitable working conditions with a reliable method, particularly when technological parameters are changed, such as the temperature and chemical composition of the steel being cast, wear and tear on the ingot mold, the intensity of cooling, etc.

The processes which occur within the ingot mold during casting most realistically characterize the course and magnitude of the friction forces between the walls of the ingot mold and the ingot on the one hand and the thermal conditions developing in the walls of the ingot mold on the other hand.

The force of friction between the surface of the ingot and the wall of the ingot mold is one of several operating factors involved in continuous casting which exerts a direct influence on the incidence of surface defects of the blanks and upon operating breakdowns during casting.

The magnitude and course of the friction force is decided not only by the quantity and quality of the casting powder that is used, but by other factors as well such as the speed of casting, the chemical composition, and temperature of the cast steel, the oscillating conditions in the ingot mold, the intensity of its cooling, etc.

Knowledge pertaining to the course and magnitude of the friction force in the ingot mold, and possibly knowledge of the kinetic thermal field of the ingot mold, makes it possible to correct deviations from the correct course of casting, including the identification of causes of such deviations, particularly:

- indications of an unsuitable operating status, for example, utilization of unsuitable or low-quality casting powder;
- detection of an unsuitable setting of parameters for the oscillation of ingot molds;
- loss of ingot mold taper;

- classification of the resulting blanks in accordance with the probability that surface defects will exist;
- indications of the increased likelihood of a breakout;
- indication of the conditions of the bath in the ingot mold, particularly the correct dosing with casting powder, inadequate steel temperature, penetration of slag from the pony ladle into the ingot mold, incidences of blanks hanging up in the ingot mold;
- inadequate regulation of liquid level in the ingot mold.

Changes in operating conditions pertaining to casting are simultaneously manifested in the magnitude and course of friction forces, in the kinetic temperature field in the walls of the ingot mold, and in the quantity of heat conducted away by cooling water. It is, thus, likely that a dependency between the magnitude and course of the friction forces on the one hand and the kinetics of the temperature field and the quantity of heat conducted away on the other hand exists and that it will be possible to find it.

Establishing the dependency of the kinetics of the thermal field of the ingot mold upon changes in appropriate technological parameters is technically demanding, generally requires the placing of several tens of thermocouples along each working face of the ingot mold; these must be placed with great accuracy and as close as possible to the working surface.

This method of recognizing and defining the immediate operating conditions of the ingot mold is accurate, although unfortunately very demanding, and is absolutely unusable in current operations. From the standpoint of actual technical realization and current operational use, the measuring of friction forces which exist between the surface of the ingot and the walls of the ingot mold appears to be readily realizable. Measuring methods used for this purpose are based on the theory and evaluation of methods involved in statistical dynamics. The magnitude and course of friction forces can be deduced from the phase difference and from its changes occurring between the course of the ingot mold path during oscillation and the magnitude and course of the forces causing the oscillations. Another method consists of evaluating changes in mutual spectral output densities, the course of acceleration of the actual ingot mold and the drive mechanism causing the oscillations. Some fragmentary results can also be obtained from the amplitude analysis of forces impacting on the ingot mold during the course of casting.²

The processing of measuring signals by methods involved in statistical dynamics and the practical utilization of these methods, whose secondary characteristics quantitatively characterize a random process in linear or linearized circuits, has a physical interpretation which is connected with the transmission of energy. Utilization of

these methods requires thorough control of the methodology involved in evaluating the signals and places increased demands upon computer technology and programming.

Specific data regarding the magnitude of friction forces, the thermal field, and the quantity of heat conducted away can be obtained solely through experimental measurements under continuous casting operation conditions and pertaining to a given type of ingot mold.

Research involved in establishing the mutual relationship between the kinetics of the temperature field, the quantity of heat conducted away from the ingot mold, and the course and magnitude of the friction forces in the ingot mold was conducted within the framework of extensive experimental measurements involving continuous casting facilities of the radial type at the Sverma Steel Plant, National Enterprise, at Podbrezova.

Ingot molds in this facility are composed of four plates made of pure electrolytic copper. The copper plates are installed in a welded steel frame. Vertical cooling openings are drilled into the plates and connect, in the lower part, with horizontal entry channels and, in the upper part, with exit ports through which cooling water runs. The system which uses water as a coolant and the cooling of the water constitutes a closed circuit. The design of the ingot mold facilitates the subsequent machining of all plates following wear and tear of 1 to 2 mm and makes it possible to reassemble them to the original dimensions. To achieve the oscillation movement, the ingot mold and the frame are mounted on a table which is guided by the drawbars of the parallelogram. The table is connected to a connecting rod, the other end of which is swivel-mounted on the eccentric end of a drive shaft which is driven by an electric motor equipped with a ballast resistor which, in turn, facilitates the remote changing of the oscillation frequencies.

The level of steel in the ingot mold is protected by the introduction of casting powder. During the course of preparing the individual experimental measurement campaigns it was necessary to undertake certain supplemental measurements, design changes in the ingot mold frame, to develop and produce some necessary measuring instruments and fixtures. The requirements for this activity were based on preliminary evaluations of the individual measuring campaigns and also upon the experiences gathered by workers at the steel plant following several years of operating the continuous casting facility. It is possible to designate the following as being substantive in this regard:

1. Development of production of a measuring device to facilitate rapid measurement of ingot mold wear. To determine the magnitude of relative wear in a radial-type ingot mold following each cast sequence, a special measuring device was developed on the basis of experience gathered by workers at the Poldi United Steel Works,

National Enterprise, at Kladno. The device permits the continuous measurement of the internal dimensions along the height of the ingot mold with an accuracy of hundredths of a millimeter.

2. Also, for the accurate positioning of the ingot mold along the technological axis, a special measuring device was developed and produced, again on the basis of experiences gathered at the Poldi United Steel Works in Kladno. The measuring device is described in a special chapter.

3. During the course of the first measuring campaign an apparent lowering of the thermal flows in the ingot mold was noted in dependence upon the number of cast melts. Consequently, the status of new materials and the utilized copper plates was verified in physical metallurgy laboratories. The structural status of a new and unused copper plate was formed by α grains and corresponded to the status after annealing. Under current operating conditions, when the temperature of the working surface of the plate of the ingot mold, according to measurements and calculations involving the thermal field, did not exceed 270 degrees Centigrade, no changes were noted in the structure. In view of the character of the solubility of iron and copper, Fe can penetrate into the Cu to a maximum depth of 0.01 mm. The investigation did not prove that the noted changes were caused by structural changes or changes in the chemical composition in the region of Fe-Cu contact.

4. According to measurements of dimensions and ingot mold wear which were conducted involving use of the ingot mold following the second and third machining, the experiences of workers operating the continuous casting facility was confirmed, that is to say, taper is lost first in an ingot mold which is used for the first time and last in an ingot mold which is used following most recent machining.

After the first measuring campaign which measured the heat flow passing through individual plates and during which the computation of thermal fields was accomplished, it was found that the surface temperature of the ingot mold plates did not exceed 270 degrees Centigrade even in critical cases where the flow-through of cooling water was substantially decreased. It can therefore be anticipated that the loss of taper in individual ingot molds occurs on the basis of plastic deformation of the plates and on the basis of warping of the working surfaces of the plates. We verified this fact through an experiment in which these deformations were caused even before the first machining of the plate working surfaces.

5. The elevation was raised from the original 6 mm to 3 mm and wear on the ingot mold and the surface quality of the final product was monitored. In subsequent experiments, this change proved to be favorable.

6. The frame of the ingot mold was reconstructed to permit installation of three dynamometer sensors on which the ingot mold core rests. At the same time, the section containing the base rollers was redesigned to determine the reason for the cracking of the adjustment screws.

During the course of the first experiments, the fact that the misalignment of the ingot mold by 2 mm from its technological axis caused changes in the heat stress experienced by the ingot mold walls in the direction of the misalignment by 25 percent was verified. This determination led to the requirement to develop a measuring instrument for the rapid and accurate realignment of the ingot mold with its technological axis.

Ingot Mold Alignment

The correct technology of continuous casting makes it possible to significantly reduce the incidence of defects in the final product. Correct technology is also understood to mean good machine setup. For example, the improper adjustment of the position of the ingot mold causes unevenness in conducting heat away from the solidified skin of the steel and gives particular rise to the incidence of diagonal and subsurface fissures.

The casting track for continuous casting at the Sverma Steel Plant at Podbrezova is made up of several independent units. The first unit is the actual ingot mold, connected with a ballast resistor which develops the oscillation movements—Figure 1 [not reproduced]. In the ingot mold, which is formed of its core, the cooling plates, and the base plate, the solidified skin of the blank is formed. The base rollers connected with the ingot mold are intended to provide support for the solidified skin and to minimize the incidence of extra-axial forces which are transmitted from the blank to the plate of the ingot mold core. The next technological unit in the direction of the movement of the blank is the first guide segment. The guiding of the blank is accomplished by four horizontal support rollers, four horizontal guide rollers, and four pairs of vertically mounted guide rollers. The task of the horizontal and vertical guide rollers is to guide the stopper and that is why there is a gap of approximately 10 mm between the surface of the blank and the surface of the roller. The task of the horizontal support rollers is to support the blank from the large side of the radius ($R\ 9,000$). The maximum permitted deviation of the surface of the rollers from the theoretical circle having a radius of 9,000 is plus or minus 0.5 mm. The upper part of the guide segment has mounted on it the nozzles for secondary blank cooling. The first guide segment is followed by a suitably designed guide segment II from which the blank moves into the working rollers of a drawing mill I. The casting quarter arch is, thus, determined by the horizontal axis of the ingot mold and the vertical axis of drawing roll stand I. Both axes are at right angles to each other and their point of intersection

defines the center of the casting arch. The angle magnitude of guide segment I is approximately 35 degrees and of guide segment II, approximately 47 degrees.

The design of the continuous casting facility makes it possible to effect the independent exchange of individual technological units. The control and possible exchange of the guide segments is accomplished approximately four times per year during continuous casting facility medium-type repair cycles. The duration of continuous ingot mold operation is substantially shorter; in practical terms, one or another of its four casting streams is exchanged virtually every week. For purposes of setting up the individual technological units, special single-purpose devices are utilized outside of the actual continuous casting installation. For aligning the rollers of the guide segments, an R 9,000 template is used; special rulers are used for setting up the base rollers. The position of the ingot mold core in relationship to the base plate is generally changed in conjunction with machining of the plates. Consequently, when changes are being made, it is necessary to position the new ingot mold in such a way that its large radius lines up with the theoretical R 9,000 circle or with the covering of the support rollers of the guide segments with an accuracy of plus or minus 0.5 mm. In this position (see Figure 1), the axis of the ingot mold is in the horizontal direction and the tangent to the axial circle R 8,900 at the point of intersection with the axis of the ingot mold coincides with the axis of the flow. To set up the mutual linkage of the guide segments and the linkage between guide segment II and the rollers of draw roll train I, it is possible to make use of the R 9,000 template. The use of this template for the mutual positioning of the ingot mold of guide segment I is not suitable in view of the frequency of the necessary exchanges and the required accuracy. Consequently, it was necessary to produce a special jig which facilitates rapid and accurate positioning of the ingot mold into its technological axis.

In view of the required accuracy, use was made of a jig operating on the principle of an optical sight. The complete optical sight (see Figure 2 [not reproduced]) is composed of a sighting telescope at the top, by a clamping chuck, and line-of-sight diagram. The sighting telescope is mounted on the upper part of the clamping chuck by the method which is shown in Figure 3 [not reproduced]. The clamping chuck assures a firm and accurate connection between the sighting telescope and the core of the ingot mold in such a way that the line-of-sight axis of the telescope is parallel with the axis of the material flow. The clamping is accomplished by a pair of symmetric contacts with spherical contact terminal areas which are controlled via cone-shaped inserts by operating springs. The mechanical construction of the clamping chuck utilizes a proven design used in the Poldi Plant in Kladno.⁴ This design was adjusted for another ingot mold dimension and for a radial-type continuous casting facility. Before the sight is placed into the ingot mold, a control lever is used to depress the operating springs and the sight is inserted into the core of the ingot

mold with the contacts in a diagonal position. Letting up on the operating springs assures the accurate centering of the clamping chuck. The axis of the lower contacts is then on the same plane as the axis of the ingot mold; the axis of the upper contacts is positioned 50 mm beneath the upper edge. All contacts are located in the upper half of the ingot mold core, that is to say, in the part which shows the least amount of wear during operations. The upper part of the support tube of the clamping chuck contains a level table with two accurate spirit levels (see Figure 3), positioned at right angles to each other. The ingot mold is positioned into a vertical position with the aid of set screws, that is to say, into the position in which the spirit levels are in balance. The horizontal roller frame of guide segment I houses a line-of-sight diagram at a distance of 1,350 mm from the upper edge of the ingot mold (see Figure 1). To facilitate the rapid and accurate mounting of the line-of-sight diagram, the frame is equipped with two auxiliary pins. The telescope of the optical sight is used to observe the transilluminated line-of-sight diagram and the ingot mold is moved until the cross hairs in the telescope coincide with the central cross of the aiming diagram. In this position, the ingot mold is secured with lock screws.

The prototype of the optical sight was produced by the Institute for Ferrous Metals Research at Dobra and it was operationally verified during the course of experimental measurements conducted on continuous casting facilities. The angular accuracy of sighting with a telescope is given by its magnification and, in our case, this accuracy amounts to plus or minus 4 sec. The angular accuracy using the spirit levels is also plus or minus 4 sec; this means that the theoretical accuracy for aligning the mutual position of the ingot mold and of guide segment I, when measured in the plane of the sighting diagram, is plus or minus 0.02 mm. Actual operating accuracy will, thus, be primarily given by the accuracy of the positioning of the clamping chuck within the core of the ingot mold. During operating tests, this accuracy was determined by the repeated insertion of the sighting device and by having various persons read the position of the cross in the sighting diagram. These tests showed that the stabilization of the optic sight is not dependent on the operating crew and that the accuracy of measuring the mutual positions of the ingot mold and of guide segment I in the plane of the sighting diagram is plus or minus 0.05 mm. Operational tests show that the optical sighting device facilitates not only the accurate, but also rapid positioning of the ingot mold used in current continuous casting operations.

Experiments Involving the Working Conditions of the Ingot Mold

Experiments were conducted while the device was in full operation at the Sverma Steel Plant in Podbrezova and were aimed at obtaining as complete a picture as possible of the functions of the continuous casting facility and the quality of production. The main experiments were conducted at the first casting line which was equipped with

the necessary sensing devices. Accompanying tasks, having to do mainly with measuring of ingot mold wear and verification of casting powders, were conducted on the remaining casting lines. The measuring program was stipulated in accordance with the results of previously accomplished partial operational and laboratory tests and was divided into the following basic tasks:

- measurement of technological parameters of the continuous casting device;
- monitoring ingot mold wear;
- the taking of samples for judging quality, determining the product skin, and sampling the quality of the liquid core;
- the stipulation and verification of the method used to set up the geometric axis;
- monitoring the characteristics of casting powders;
- the keeping of melt records and detailed documentation about melts.

Following is a listing of measured and recorded magnitudes (for schematic, see Figure 4 [not reproduced]).

$t_{x,y,z}$	Distribution of temperatures in individual walls of the ingot mold
t_{v1}	Temperature of cooling water at the primary coolant entry port
t_{v2}	Temperature of cooling water at the primary coolant exit port
Δt_{v1-4}	Temperature difference of cooling water between entry port and exit port of the appropriate ingot mold wall
Q	Quantity of cooling water in the primary circuit
Q_{1-4}	Quantity of cooling water in the individual ingot mold walls
p_1	Pressure of cooling water at the primary circuit entrance port
p_2	Pressure of water at the primary circuit exit port
t_p	Temperature of steel in the ladle
t_{mp}	Temperature of steel in the pony ladle
t_k	Temperature of steel in the ingot mold
h_k	Level of steel in the ingot mold
$a_{x,y,z}$	Acceleration of the ingot mold in three directions which are perpendicular to each other
l_k	Course of ingot mold oscillation
a_{oj}	Acceleration of oscillation mechanism connecting rod
F_T	Stress on the oscillation mechanism connecting rod
M_K	Torsional moment exerted by the oscillation mechanism shaft
P_w	Oscillation mechanism motor input
F_{K1-3}	Forces acting upon the core of the ingot mold in the direction of the axis of the blank
F_{H1-4}	Forces acting upon the base rollers in a direction perpendicular to the axis of the blank
F_{v1-4}	Forces acting upon the base rollers in the direction of the axis of the blank
v	Casting velocity

I_{M1}	Current used by the motor of the first draw mill
I_{M2}	Current used by the motor of the second draw mill
F_{p1}	Roller pressure in first draw mill
F_{p2}	Roller pressure in second draw mill

Measuring Methods

The temperature range designated as $t_{x,y,z}$ in the individual ingot mold walls was measured with thermal electrodes with differential hookups, positioned in precisely defined locations at five horizontal levels. At each horizontal level there were eight thermal electrodes which formed four pairs of thermocouples for copper constants. To compute the heat flow, temperatures were measured at two levels. Twenty thermal electrodes in each ingot mold wall were positioned at 1 mm beneath the working surface and another 20 thermal electrodes were positioned 5 mm beneath the working surface of the ingot mold wall. Altogether, the ingot mold had 160 thermal electrodes installed in it. The values of the thermoelectric current were registered in a measuring central. By evaluating the temperature differences obtained from the locations of measurement, some 80 temperature differences were obtained from which the temperature distribution and the temperature flows in the individual walls of the ingot mold were computed.

Temperatures designated as t_p , t_{mp} , t_k were measured with probes which had been specially adapted for individual measuring locations. The basis for this measurement was composed of the PtRh30-PtRh6(PtRh18) thermocouple. The measurements established the temperature gradient between the temperature in the ladle, in the pony ladle, and in the ingot mold.

For measuring temperatures t_{v1} , t_{v2} , t_{v1-4} , use was made of Pt100 platinum resistance thermometers which were mounted in the entry and exit piping of the primary cooling circuit, on the one hand, and, on the other hand, into the cooling water feed and takeoff servicing the individual ingot mold walls. The probes, which had four conductors, were connected to the measuring center. The measured temperatures, together with the other magnitudes obtained, were used to compute the quantity of heat conducted away from the ingot mold.

The quantities of water Q , Q_{1-4} were measured by a normally installed volume meter for cooling water in the cooling water feed of the primary circuit, as well as by a temporarily installed sensor to determine the flow rate of cooling water servicing the individual ingot mold walls. The measurements were utilized to set the flow rate required by individual variations of measurements and, on the other hand, also to determine the actual distribution of the cooling water to the individual ingot mold walls.

Input and output pressures p_1 , p_2 of cooling water of the primary circuit were measured by normally installed sensors. The measurements were utilized particularly in setting up the working conditions of the primary cooling circuit during experiments involving quantities of cooling water.

The level of melted steel in the ingot mold, h_k , was measured by a sensor developed for this purpose by the Institute for Ferrous Metals Research at Dobra. Its use facilitated the stabilization of a surface with an accuracy of plus or minus 5 mm.

Acceleration $a_{x,y,z}$, a_{oj} was measured by specially adapted piezoelectric accelerometers. The data will be utilized for computing mutual spectral output densities pertaining to the processes of acceleration of the actual ingot mold and the drive shaft of the oscillating mechanism to determine the working conditions for the ingot mold.

The course of ingot mold oscillation, l_k , was measured and evaluated by an induction sensor having an evaluative apparatus. The output signal indicated the real time position of the ingot mold.

The stress on the crankshaft mechanism, F_T , was measured with resistance tensometers which were glued to the drive shaft of the oscillation mechanism.

The moment of torque of the oscillation mechanism shaft, M_K , was measured with resistance tensometers in conjunction with an R-F converter operating with a contactless capacitor.

The input for the oscillation mechanism, P_w , was measured with a modified output converter, Model NC-100/070.

The forces F_{k1-3} acting upon the core of the ingot mold in the direction of the axis of the blank were measured by three tensometric sensors which were modified to grip the ingot mold core. The evaluation of these data, together with data for a_{xy} , a_{oj} , l_k , F_T , M_K , P_w , h_k , primarily serves the purposes of analysis of the forces created by friction between the blank and the ingot mold.

The forces acting upon the base rollers of the ingot mold, F_{H1-4} , were measured by tensometric bridges mounted on the structure of the base rollers in such a way that they would measure stress in the appropriate direction. The analysis of these forces was used in judging and setting the geometric axis for the continuous casting facility. Figure 6 [not reproduced] contains a view of the experimental ingot mold.

Casting speed was derived with the aid of a "tachogenerator" from the number of revolutions made by the motor of the first draw mill.

The current consumed by draw mills I_{M1} , I_{M2} was measured with the use of normally installed shunts and galvanically separated Model NPB converters. Evaluation of these data serves to judge the adequacy of existing regulating circuits for draw mill drives.

Pressure of rollers in draw mills F_{p1} , F_{p2} was measured with normally installed sensors.

In accordance with the program stipulated, gradual changes were made in the values of basic casting parameters such as the casting speed, the frequency of oscillations, the level of liquid steel surface in the ingot mold, the quantity of cooling water, and the type of casting powder used. All values were constantly measured and recorded at selected times by Model ORION DELTA measuring centers produced by Schlumberger and by the Model K-1280 PCM system produced by the CEC Datentechnik Enterprise. Data required for the immediate analysis of casting conditions were simultaneously registered oscillographically and by a measuring magnetic tape. For purposes of immediate analysis of the measured magnitudes, use was made of a frequency analyzer produced by the Takeda Reiken firm which facilitates the processing of data in real time for two magnitudes. In succession, data pertaining to such mechanical factors as the ingot mold track l_k , the vertical forces acting upon the ingot mold core F_{k1-3} , stress experienced by the mechanism's crankshaft F_T , and acceleration $a_{x,y,z}$, a_{oj} were processed. The monitoring and evaluation of these magnitudes and their mutual relationships in real time provided immediate information regarding changes in the conditions of casting and made it possible to predict a possible defect status. The resultant of the forces F_{k1-3} in the ingot mold mounting was also evaluated and permitted judgments to be made with respect to the correct attitude of the ingot mold in relation to the secondary coolant section and with regard to setting up the vertical axis of the ingot mold. Analysis of the magnitude of amplitudes exerted by these forces led to estimates of the distribution of friction forces acting on the individual walls of the ingot mold. Furthermore, frequency spectrums of forces and acceleration were observed and plotted and were used to precisely set the frequency oscillation for the ingot mold; analysis of the amplitudes of harmonic components and phases led to the assessment of the character of friction in the ingot mold and of the technical status of the facility.

The flow of information in the measuring and evaluation process is divided into two phases. The first phase was represented by the actual measuring process, the results of which are registered magnitudes in digital form on cassettes and magnetic tapes of the measuring centers and in written form in the measuring protocol. The second phase is represented by the evaluative process and, primarily, by the creation of complete sets of information on the computer disk in absolute physical values of the measured magnitudes. This has already led to obtaining a data base for the further processing of the experiment which is currently ongoing at four work sites

of the Institute for Ferrous Metals Research at Dobra, at the Zdar Engineering Plants and Foundries, at the Klement Gottwald Iron Works in Vitkovice, Ostrava, and at the College of Mining in Ostrava. The creative data base will serve to aid in the mastery of manipulating the data base and the creative data base will be used to establish and disseminate the interim results of individual programs or subsystems.

Wear and tear on the ingot mold—two independent methods utilizing developed devices were used to monitor wear and change of dimensions in the ingot mold. For purposes of comparing wear and tear on the ingot mold undergoing lifts of 1.5 mm to 3 mm, plus or minus, an ingot mold showing the same degree of wear as the one involved in the experiment was installed on the second casting line. On the third and fourth casting lines, the progress of the ingot mold wear was monitored using ingot molds which had been machined by various different technologies.

The taking of samples for evaluating the quality, the casting skin, and the liquid core was accomplished from the location along the blank where casting parameters were also read. The surface and subsurface quality of the blank were evaluated and the following operations were also done:

- evaluation of the blank surface after leaving the cooling bath;
- evaluation of the status of the surface of the blank on the basis of the imprints along the edges of elongated samples;
- evaluation of the width of the light band of fine coaxial crystals based on the Baumann prints of elongated samples;
- evaluation of the surface of the band of fine coaxial crystals based on Baumann prints obtained from elongated samples;
- evaluation of the surface area of the band of fine coaxial crystals based on Baumann prints of transverse samples both by measuring the entire surface of this band on a transverse sample and by examining the surface ascribed to the individual sides of the blank. Readings of Baumann prints were conducted with the aid of a digitizer; further processing was done by computer. The evaluation of internal quality was divided into two parts. In the first part, the most serious defects involving a lack of homogeneity were evaluated. The evaluation was conducted using macroetchings. During the second part, less significant defects are evaluated—segregations. The evaluation was done on the basis of Baumann prints. The evaluation of the quality was augmented by determining the thickness of the skin approximately at the instant the blank leaves the ingot mold by evaluating the surface layers of the blank which are influenced by changes in the speed of crystallization. For purposes of more precisely determining the thickness of the casting skin of the blank upon leaving the ingot mold, use was made of a method based on the principle of

volume contamination of the liquid steel in the ingot mold by charging the ingot mold with a soluble radioisotope which, over a given time and in a given area, creates a radiographically discernible interface between the liquid and the solid (already congealed) phase of the steel. To mark the liquid steel in the ingot mold, use was made of the radioactive isotope ^{32}P . Evaluation of the radiograms was also accomplished by computer. To determine the length of the liquid core, the technique of monitoring a point emitter was selected in combination with the volumetric marking of the steel to indicate the area where the steel settles behind the position at which this point occurs. At a predetermined time, the marking device was thrown into the ingot mold. Its position in the blank was localized by detection of gamma radiation. On this basis, the taking of samples was accomplished. Samples were taken from the location of the point emitter plus three others from locations of the rising activity curve (the anticipated in-pouring of lead). The length of the liquid core is then determined from how far the point emitter is away from the surface of the liquid steel in the ingot mold, that is to say, by the depth of the "fall" and by the length of the in-pouring of lead-contaminated steel in the crown of the sedimentation cone. The profile and length of the liquid core is expressly dependent upon the casting speed. Given current casting velocities of 0.7 to 0.8 meter/min⁻¹, we are talking about a value up to 8 meters; where the casting velocity exceeds 1.0 meter/min⁻¹, the length of the liquid core was measured to be 11.6 meters.

Monitoring the characteristics of casting powders—for individual types of casting powders, the above-mentioned measurements and quality evaluations pertaining to the surface, the visual behavior, the relative consumption, and "frame formation" of the powders was studied. The results are augmented by protocols from laboratory examinations.

Documentation—during the entire duration of the experimental work, special melt lists were maintained into which all data about the melt were entered, both from the standpoint of the chemical composition of the melt and with regard to casting parameters.

Conclusion

The accomplished operational experimental measurements conducted on a continuous casting facility of the radial type are original in character for Czechoslovakia. Valuable and extensive sets of measured results, permitting the deeper recognition of the process of continuous casting were obtained.

The problem of developing measuring methods to determine the working conditions of the ingot mold was divided into development of individual measuring tasks, following whose total mastery (both as to measuring

methods and data interpretation) it will be possible to determine the dependence of production quality on the working conditions of the ingot mold for any given case.

The experiments clearly confirmed the considerable influence of the accuracy of technological axis setup upon the uniformity of the heat stress to which the plates of the ingot mold are subjected and upon their wear.

A partial analysis of the results of measuring thermal-technical magnitudes also points to the existence of reserves in ingot mold cooling, in actual ingot mold design, and to the suitability of introducing the regulation of cooling water quantities.

The experiment involving ingot mold plates prior to their first machining proved that they are subject to plastic deformation.

Because of the considerable extent of the problem being solved and the resulting extent of measured data, it was not possible to accomplish their final evaluation because of the pressure of time, since the latter demands a deeper analysis and mathematical processing. The sets of data led to the establishment of an extensive computer data base with the aid of which it will be possible to seek correlative dependencies and, at the same time, it will make it possible for a wider circle of specialists to utilize the results.

The experimental work was participated in by a collective of 43 workers from 6 different organizations—the Institute for Ferrous Metals Research at Dobra, the College of Mining in Ostrava—the department of thermal technology, the Research Institute of the Klement Gottwald Iron Works in Ostrava, the Metals Research Institute at Horni Briza, the Zdar Engineering Plants and Foundries, and the East Slovakia Iron Works at Kosice, as well as by operators, maintenance workers, and technical development employees of the Sverma Steel Plant, National Enterprise, at Podbrezova.

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SCIENCE & TECHNOLOGY POLICY

Hungarian Academician Critical of Basic Research, Industry Relationship

25020051 Budapest DELTA IMPULZUS in Hungarian No 6, 26 Mar 88 pp 26-27

[Article by Erno Pungor, academician: "Basic Research—Innovation—Industry. What, Where, How?"]

[Text] Erno Pungor (65), academician, head of the General and Analytical Chemistry Department of the Technical University of Budapest, a student of Aladar Buzagh and Elemer Schulek and an internationally known expert on ion-selective electrodes, is a fanatical advocate of the importance of close cooperation between research and industry. As proof: the number of his domestic and international patents has long exceeded a hundred and an innovation park has been active in his department at a time when the concept was hardly known in Hungary.

1. Current State of Hungarian Industry and Research

To this very day, our industry has born to a large extent the features of "war production"—the pronounced marks of a closely planned economy—and this has had an unfavorable effect not only on the level of production but primarily on the hunger of industry for innovation. It is derived in part from this structure that the industrial leaders actually prefer when guidance comes from above rather than having to manage the enterprise by taking risks. It also follows that economic management is characterized not by long-range, perspectivist planning but often by insufficiently thought through, short-range measures.

Furthermore, problems are created by the absence of basic industrial training among many of the industrial leaders who then have difficulty enforcing the technical requirements in production. In a significant number of the leaders, however, it is not so much a basic technical training that is lacking but rather a creative industrial experience. At significant governmental decision makings which define industrial development, independent experts are mostly absent from the committee which prepares the decision. The situation is also made more difficult by the fact that, under the "quasi-market" conditions, they are not really forced to promote the exchange of their products together with the risks.

The sphere of research and development, too, is in a difficult situation. Because of the pressing economic problems, basic research increasingly contracts, the

research establishments—in the interest of their own survival—are engaged, instead of long-range, perspective efforts, in the solution of short-range, daily problems in order to earn money. The research situation is made significantly more difficult by the fact that the financial resources are burdened by many individuals unsuited for research. It should be mentioned, however, that until the most recent times, the results of domestic basic research evoked international recognition in several fields. The results which earned international notice were in general achieved by scientific schools, but their number is lower than necessary.

Support of the area of development that is coupled with research is actually even worse than that of basic research. Of the annual 30 billion forints appearing in statistical reports, only a fraction is actually spent on development and we have no clear picture how the remaining fraction is being spent.

The results of basic research can appear in practice as innovations that had been carried through the developmental phase. However, the domestic conditions for this are available only in small measure. A role is played in this by the fact that, certain economic policy decisions are needed for the creation of more favorable conditions for innovation.

An additional handicap is provided by the fact that only a very small portion of the current domestic patent reports is responsive to the demands of an adequate product rotation rate (an average of 8 years/product). The absence of financial support plays an important role in the lag. In this respect, a particularly difficult situation was created by the inconsistent economic direction in recent years.

During a recession, more highly developed countries, in general, launch a large-scale technical development. In contrast, in our country, the government, to this day, wants to economize on the financial basis of research and development. With respect to innovation, a peculiar difficulty is created by our foreign trade which is not even capable of purchasing the products needed for innovation efforts—in part because of the industrial and marketing structure of the other socialist countries; in part because, under existing foreign trade regulations, purchases from Western countries are slow and unreliable. It also happens that imports and exports in socialist relations are limited in such a manner that thereby we also deprive ourselves of long-range possibilities. We fail to attain the reasonable goal whereby contingencies would be better exploited for the development of products with greater intellectual content and of industrial structure.

In accomplishing the tasks faced by our country's science and industry, we encounter another basic difficulty, in addition to the problems mentioned: the lack of an adequate number of appropriate experts. During the past

decades, the training of intellectuals has not been developing adequately in Hungary (since the sixties, the number of participants in higher education has been stagnating around one hundred thousand). The proportion appears to be even poorer in university education. Development of quality in training has become "frozen." Technical intellectuals cannot satisfy the demands of the country's more modern industry either in numbers or qualitative make-up. Nevertheless, it is functionally part of this picture that some of our technical intellectuals withstand any international comparison. (This is also promoted by the system of continuing scientific training introduced in recent years). The qualitatively adequate fraction, however, is far below the numbers that would be required by modern industry in Hungary.

2. Tasks of Science With Regard to Country's Economy

In the ensuing period, the development of science management must manifest itself primarily in the support of the scientific schools already developed in the country, the facilitation of the establishment of new schools and the willingness to liquidate the activities of research establishments which fail to produce scientific results.

The quantity of natural scientific and technological basic research must be planned in a manner to provide an adequate basis for a high level of innovation. (Based on the number of our current industrial units, we should appear with 8 to 10 thousand new products and technologies on the market a year. If we want to provide 5 to 10 percent of these with products of the highest standard, then 500 to 800 basic research results suitable for innovation are needed annually. With this go 15 to 20 thousand completed basic research projects).

Current domestic basic research cannot satisfy this demand because of the lack of schools. Therefore, it is necessary that science management relieve the already existing schools from efforts aimed at solving short-range tasks in order to maintain the particular institution. Thus, science policy needs to manage the sums spent on basic research much more selectively. In modern basic research planning, a competitive system must be further developed which aims to avoid campaigns and to promote school-building activities.

In judging the acceptability of scientific results, international science must be included. In areas where domestic science is weak, distinguished foreign scientists must be asked to cooperate in the evaluation (therefore—purposefully—it should be required that applications be submitted in Hungarian and in English).

On the one hand, the evaluation of basic research results is made possible through their acceptance by international science (publication in high-level journals). On the other hand, permanent evaluating committees for science and technical development should be established—limiting the excessive growth of committees by adequate

coordination—which are to award basic research funds. The same committees would evaluate the results of basic research as to their potential for innovative development. Their recommendations would be regularly sent to the appropriate industrial area. Innovation workshops could be moved next to scientific schools as long as the school is of sufficient size to supply the workshop with material for innovation. (Such moves would already be possible with 60 to 80 basic research results per year).

The economic conditions of the innovation workshop must be regulated in such a manner that from its products it should be able to finance not only its continued existence but also an expanded new production. The leading products on the market must be expected to come from these workshops. In initiating the workshops, it should be fundamentally taken into account that the cost of innovation may be 20 to 30 times the sum needed to produce the basic research result.

3. Tasks of Industry in Applying Scientific Results

The establishment of a modern industrial structure is a basic task for the economic and industrial management of the country. One step toward this is the establishment of an industrial distribution profile, with controls, such that the proportion of small enterprises reaches 95 to 99 percent of the total number of enterprises. (It is not by chance that the innovation activity of the Western-European Union is primarily concentrated on the small and medium-sized enterprises, as seen in its report to the Parliament of the European Community.) In our country—according to 1985 data—the number of state owned industrial enterprises is 974 with 1294 being the average number of workers. The number of small enterprises is estimated to be more than 4000 but medium-sized (100 to 300 workers) enterprises are practically absent.

It is of fundamental importance that it should become an increasingly perceptible endeavor on the part of the government to speed up technical development and within it to employ controls which promote technical development through tax incentives, also including the sums earmarked for the support of basic research. The acknowledgment of creative technical activity aimed at innovation must also be expressed through tax benefits in the individual income tax system as well.

A further basic requirement of technical development is market research, marketing. The searing backwardness in this area must be urgently remedied. This requires in the first place a significant improvement of the market information system, the improvement of relations between industry and basic research in terms of incentives and information flow, and furthermore, the training of marketing experts. More up-to-date processing of information obtained from abroad and produced domestically (licenses, know-how) must be placed in the forefront. The government would play an important role in

the essential improvement of the information exchange between the research machinery and the machinery active in international foreign trade.

There could be basic improvement in the content and quality of the technical development plans of the enterprises through the establishment of scientific councils to which the most outstanding domestic and, eventually, foreign experts in the particular field are invited as members. The task of the scientific councils would be to provide direct help to management through the evaluation of information; for this reason it is practical for such councils to function, on the foreign model, as organs of the highest management in the industry. It is also practical to lift the technical development groups of the enterprises from the current hierarchy and assign them to the upper management.

The hunger for industrial innovation, in the final analysis, depends on the markets. Therefore, it is decisively important that our industrial enterprises be truly exposed to the effects of the market and the budget not buffer the effects of the market. It is similarly very important to acknowledge that the country must accomplish a significant part of its innovation activity directly within industry.

4. Relationship Between Science and Industry

The build-up and further development of an effective system of relations must be accomplished at several levels.

4.1 The earlier mentioned mode of the transfer of basic research results into practice makes the establishment of direct relations possible insofar as the individual or individuals responsible for the basic research result can or must be involved in the innovation.

4.2 Primarily the domestic research base will be able to solve the unsolved tasks of industry in innovation. Through this, new connections will be created between science and industry.

4.3 Through members of the scientific councils, to be established within industry, science and industry will directly engage in raising the questions, on the one hand, and, on the other hand, the particular field of science will be directly informed about the questions arising in industry through members of the councils.

4.4 The products of innovation workshops located or to be located next to the scientific schools can be taken over by industry. This represents an additional creation of connections between science and industry.

4.5 Important connections may develop between science and industry whereby industry will be able to analyze with the help of scientific researchers the developmental trends in areas important to industry for purposes of formulating plans of its technical development.

TELECOMMUNICATIONS S&T

Bulgarian Fiber Optics Communication Detailed 22020006 Sofia ELEKTROPROMISHLENOST I PRIBOROSTROENE in Bulgarian No 4, 1988 pp 15-18

[Article by Engineers Man'o S. Manev, Dimitur T. Pankov, Danail B. Danailov and Krasimir G. Bechev: "Fiber Optics Communication System With a Transmission Speed of 8 Mbits and Wavelength of $0.85\mu\text{m}$ "]

[Text] UDC 681.7.06/.07:654.17

Fiberoptic lines with a transmission speed of 8 Mbit/s, operating on a light wavelength of $0.85\mu\text{m}$, are applied in public communications grids for the transmission of 120 telephone channels with impulse-code modulation. However, they could also be used in other sectors of the national economy, such as transportation.

In communications, their purpose is to connect two rayon telephone switchboards within the same settlement. The distances to be covered rarely reach 10 kilometers. This largely determines the expediency of the use of fiber optic lines consisting of two terminal stations with an optic equipment operating on a wavelength of $\lambda = 0.85\mu\text{m}$.

Each terminal (terminal line optical equipment, KLOO) contains the following basic separate functional blocks: coder and regenerator, optical emitter, optical receiver,

power decoder and regenerator (Figure 1). Let us consider the structural features of the system developed by the IRET.

Coder and Input Regenerator

The schematics of the coder and decoder were developed by IRET specialists and were accepted as inventions.

Structurally, the coder and regenerator are enclosed within a single chip.

The type of coding method chosen is one in which a code of the 1B2B is formed by the HDB-3-signal, directly, suitable for transmission with an optical fiber. Figure 2 describes the function of the coder. The arms indicate changes in the internal condition under the influence of a corresponding input signal and the generated signals with a corresponding internal condition are indicated in the circles.

The coding is achieved with a D-type trigger, numerically linked, including also the use of its asynchronous control RS inputs. This avoids the relatively complex HDB-3/BIN and BIN/HDB-3 relatively complex transformers.

The functions of the input regenerator are reduced to extracting and doubling the rate frequency and strobing of the input signal. The effect of the regenerator is the following: from the input signal (with three levels) in the HDB-3 code the positive and negative impulses are

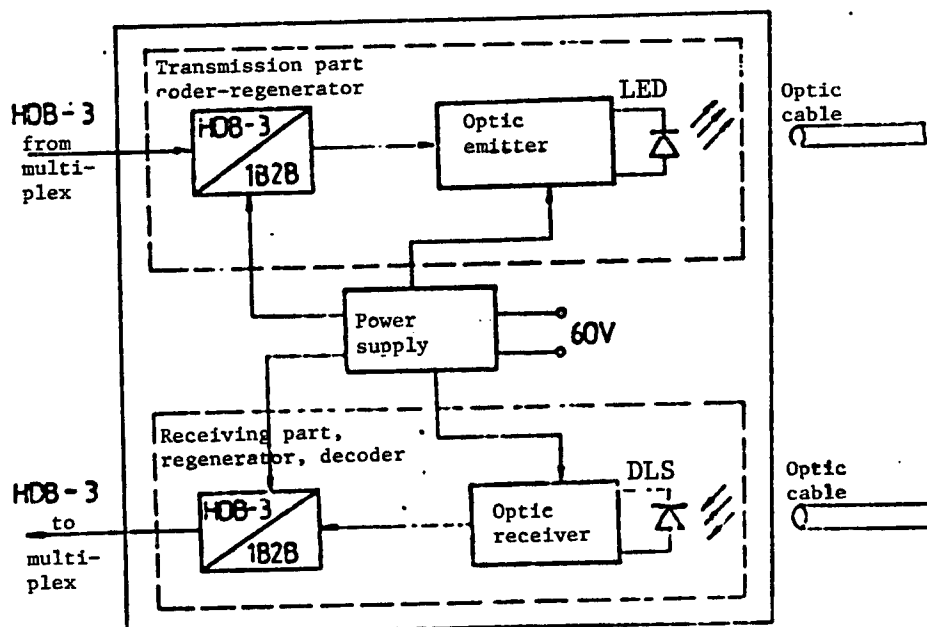


Figure 1. LED—Light Emitting Diode; DLS—Diode Light Sensor (Photodiode)

separated into two sequences with a TTL level (one for positive and the other for negative impulses). The two sequences are summed up and the thus obtained signal is subjected to logical differentiation in order to obtain a signal convenient for the burst activation of a vibrating circle tuned for the doubled rate frequency.

After the vibrating circle, the signal with the doubled rate frequency is converted into a signal with a TTL level by a comparator which operates as a rectifier. With this rate the two input series are strobed with the help of triggers controlled along the front of the impulse.

The signal thus obtained is fed to the optical emitter.

Optical Transmitter

The purpose of the emitter is to modulate the beam radiated by the photodiode with the signal received from the coder output. The modulation of the beam of the photodiode takes place through the modulation of the current in a straight line.

The emitter also includes a system for protecting the photodiode in the case of a lack of signal from the coder output. It traces the existence of transitions in the signal which modulate the photodiode current. If within a stipulated period of time (established by the time constant of the monovibrator) no transitions to the input signal take place, the flowing of the current through the photodiode is stopped. This increases the durability of the used light radiating element, which increases the reliability of the system as a whole. In this case we used an optical radiation element of the NDL 4103P type, manufactured by the Japanese NEC company. Some of its more important parameters are the following: radiated optical power, introduced in the gradient fiber of 50/125 μm greater or less than 50 μW (minus 13dBm), a width of the light spectrum of up to 40 nm, time of increase and drop of the modulated signal under 10 ns, with good temperature dependence.

In the use of the 1B2B balance code, the average value of the optical power emitted by the photodiode equals one half of the impulse one.

The emitter also offers the possibility of modulation for an intensity of up to 10 percent of the amplitude of the signal in the frequency band of up to 10 kHz, which allows the inclusion of an official channel in this band and its transmission along the optic cable.

There is also a signaling device at the input signal, achieved with a photodiode installed on the face side of the chip.

Optical Receiver

The purpose of the optical receiver is to transform the incoming optical signal into an electric signal with a TTL level.

The possibilities of the system are largely determined by the characteristics of the optoelectronic receiving module, built in the receiver, which is the input part of the optical receiver. The module consists of a Bulgarian-made cumulative photodiode with a free booster with a hybrid integrated circuit, in the first step of which a field transistor has been used.

After the optoelectronic reception module, the signal is boosted by a two-stage booster. In order to ensure the necessary dynamic range, a stage for automatic regulation of the amplification has been installed before each of the amplifying stages.

This is followed by a comparator, the signal from which is strobed by the system for the input signal which must fall in such a way that if it drops below the threshold of the maximal input sensitivity of the output of the comparator a signal with a permanent H level is set.

In addition to the steps for automatic control, the system for the automatic control of the amplification also controls the tension of the cumulative photodiode. The oscillator of the transformer for the cumulative photodiode is a generator of sinusoid signals, in order to reduce the pulsing after the output has been adjusted.

The receiver has also a separate signaling output should the input signal drop below the threshold of the maximal sensitivity of the input.

Decoder, Regenerator, and Terminal Stage

The regenerator of the receiving side operates as follows:

After the resolving system (level comparator) of the receiver, the signal is subjected to a logical differentiation and the burst of the thus obtained impulses triggers the vibrating circle with is tuned by the doubled rate frequency. With the help of the comparator impulses with the same amplitude are set, which are fed to a system for phase automated frequency tuning (PLL).

After the strobing of the impulses, developed by the resolving system of the receiver, a rate signal from the output of the system for the restoration of the rate (PLL) results in a signal which has been rectified in terms of form, amplitude and time.

The purpose of the decoder is to transform the received and regenerated signal into an outgoing code HDB-3.

The terminal stage generates an outgoing signal with the HDB-3 code with the necessary parameters—amplitude and form of impulse and the duration, based on the forming step (in accordance with the recommendations of the MKKTT).

Power Supply

The system is powered by a DC/DC transformer, based on the principle of the width-impulse modulation (impulse type). It ensures stabilized work tensions of +5V/5A - 5V/1A and +12V/0.5A. The work range of the transforming tension is from 42 to 72 V. The efficiency is 85 percent is at maximal load. There is a warning system should any of the initial voltages drop.

The transformer of the converter has a ferrite core of the AC/19/12 type. In order to achieve good magnetic linkage and high efficiency, a stratified sectional winding of the bobbins has been used. In order to avoid skin effect losses all secondary coils have several parallel wire connections.

Structural Features

Each terminal station is placed in a mechanical cassette 510/131/210 millimeters, in a bracket of the 57 UTS-100 unit type. This makes the system convenient for assembling in the various communications grid projects.

Measurement Results

With an optimal coefficient of a rate multiplication (for a speed of 8.448 Mbits/s) the figure of -54 dBm was obtained in determining the sensitivity of the receiver under real conditions.

On the basis of the measurements conducted to determine the responsiveness of the receiver and the emission power, the length of the optic line was computed (or else the so-called capacity budget was drawn up).

Nominal discharge optical capacity (in optical connector)	-14.5 dB.
Structural reserve of the emitter in terms of increased temperature by 30° C	0 dB.
In terms of aging (drop of capacity at the end of the utilization of the meter)	1.5 dB.
Nominal responsiveness of the receiver	-54 dBm.
Structural reserve of the receiver in terms of increasing the temperature by 30° C	2 dB.
In terms of aging	1 dB.
Energy potential	35 dB.
Energy reserve of the equipment	4 dB.

Optical Cable

Dampening in the optical cable	3 dB/km.
Losses from fiber welds	0.5 dB/km.
Reserve for cable maintenance (1 interruption-2 connections)	1 dB.
Losses from cable aging	0.2 dB/km.
Length of line	8.5 km.

The measurements were made with the help of an alternating optical attenuator which is used to simulate various lengths of the optic track, thus neglecting the dispersion factor in the optic fiber. The great sensitivity of the optic receiver, obtained with a breakdown silicon diode, makes it possible to cover large distances in the use of photodiodes.

In order to cover such distances, an optical cable with gradient fibers and small dampening must be laid along the tracks (3-3.5 dB/km). The requirements concerning the frequency band of the cable are low because of the low transmission speed. According to MKKTT recommendations, the frequency band of the line between the two terminal stations in the case of 8 Mbit/s should be no less than 20 MHz, measured on the 3 dB level. This requirement is easily met with modern optic cables. There would be no worsening of the energy potential of the line from mode dispersion in the use of a cable with a gradient fiber with a frequency band in excess of 250 MHz.km (which is easily attainable).

As to the influence of the physical dispersion, at a distance of 7-8 kilometers or more, the quality of the light diode of, more precisely, the effective value of the spectral emanation width, has a great influence. In the use of high-power photodiodes, introduced in the fiber, but with a wide radiation spectrum (40-50 nm) and a fiber with a physical dispersion of no less than 100 ps/nm/km, should losses in the line and its energy potential allow such distances, it may turn out that the line is limited by dispersion. In that case a reserve of 1.2-2 dB should be contemplated for the drop of sensitivity of the receiver in the inter-symbol interference, due to physical dispersion.

The attained results indicate that a distance of some 10 kilometers can be covered without the use of an intermediary regenerator. The high energy balance of the system makes possible the transmittal of information without the use of a laser diode.

The implementation of such an optical system will improve the quality of communications.

(Received on 13 January 1988.)

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